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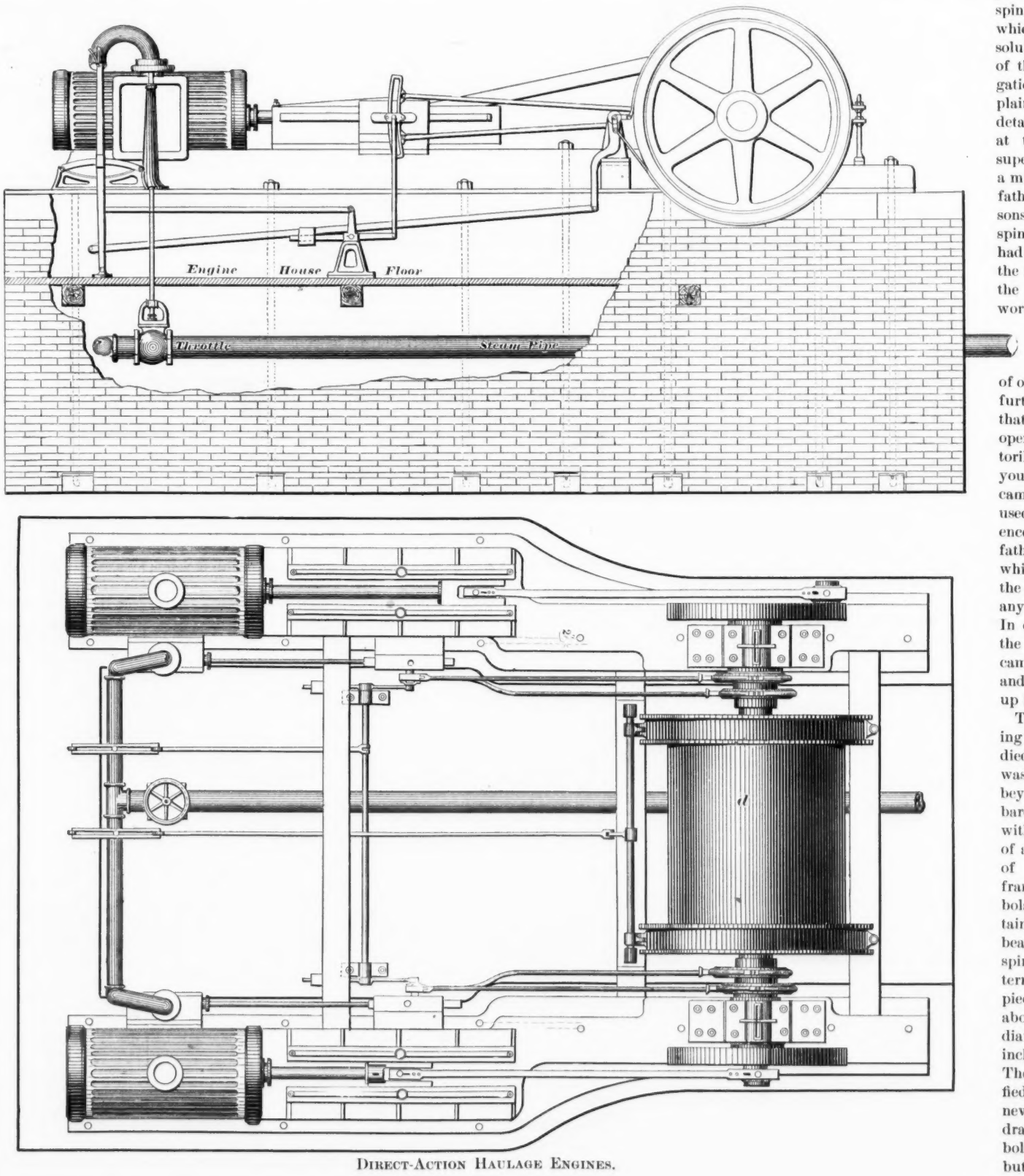
Direct-Action Haulage Engines for Mines.

The more common practice in haulage plants for mines is to use geared engines running at a speed in revolutions several times greater than the speed of the winding drum. This has been the practice of the firm of J. & J. B. Milholland, Pittsburgh, Pa., builders of the direct-action plant illustrated on pages 1 and 2. The plant shown is the first one of the kind built by this firm, although they have put down 75 geared plants. Experience with this plant, which is in successful operation at the Redstone Coke Works, near Uniontown, Pa., has convinced the builders that the direct-action plant, where there are no objections to its employment, is superior to the geared type, some of the advantages being smoother running, diminished wear and greater simplicity, the whole resulting in greater economy of operation.

The engines here shown are used for hauling coal cars, or wagons, up a slope of 1½ miles in length, the grade being 20 feet to the hundred. The engines are 18″x40″, connected at right angles to the shaft that carries the winding drum. This drum is 4 feet 6 inches diameter, and holds 1½ miles of ⅞-inch steel rope. It is provided with a double friction, operated in the usual manner. The bed-plate to which the cylinders are bolted is a heavy casting, 18 inches in height; in fact, all parts of the machinery are heavy and substantial, as is required in this class of work.



DIRECT-ACTION HAULAGE ENGINES.

The steam distribution is by means of the ordinary link motion, to provide for running in both directions. Other details, and the general arrangement of parts, can be seen by an inspection of the engravings.

A Legal Foundryman.

BY C. J. H. WOODBURY.

It has been said that a lawyer in practice should know something of everything, because he would sooner or later be required to use that knowledge in some details of the litigations with which he might be connected. An illustration of this fact occurred in Providence, R. I., during the progress of an important patent suit on spinning machinery, in which the maintenance of the rights patented were contested on the ground that the patent was not a valid one, as it lacked the element of novelty, by reason of its having been anticipated by a spinning frame, containing the identical features, which had been built and operated some twenty years before.

The lawyer retained by the patentees had in his boyhood days played in his father's foundry and machine shop. He had often made patterns out of wood and moulded them in the sand. When the men were casting in the foundry, some of the iron would be poured into these moulds, and in turn the boy would finish his castings into various wheels for carts and other toys. In this manner he obtained, by close observation and practice, a good knowledge of the principles of moulding.

In the case referred to, the testimony in opposition to the patent was all given by one man, who claimed to have made, some twenty years before, a spinning frame which was an absolute anticipation of the one in litigation. He explained in great detail that he was at the time the superintendent of a mill owned by a father and several sons, and that the spinning frame had been made in the repair shop of the mill, the men working on it at times when there was no especial need of other work. He further testified that the frame had operated satisfactorily, but that the young men became jealous and used their influence with their father to an extent which prevented the construction of any more frames. In course of time the machine became worn out, and was broken up for old iron.

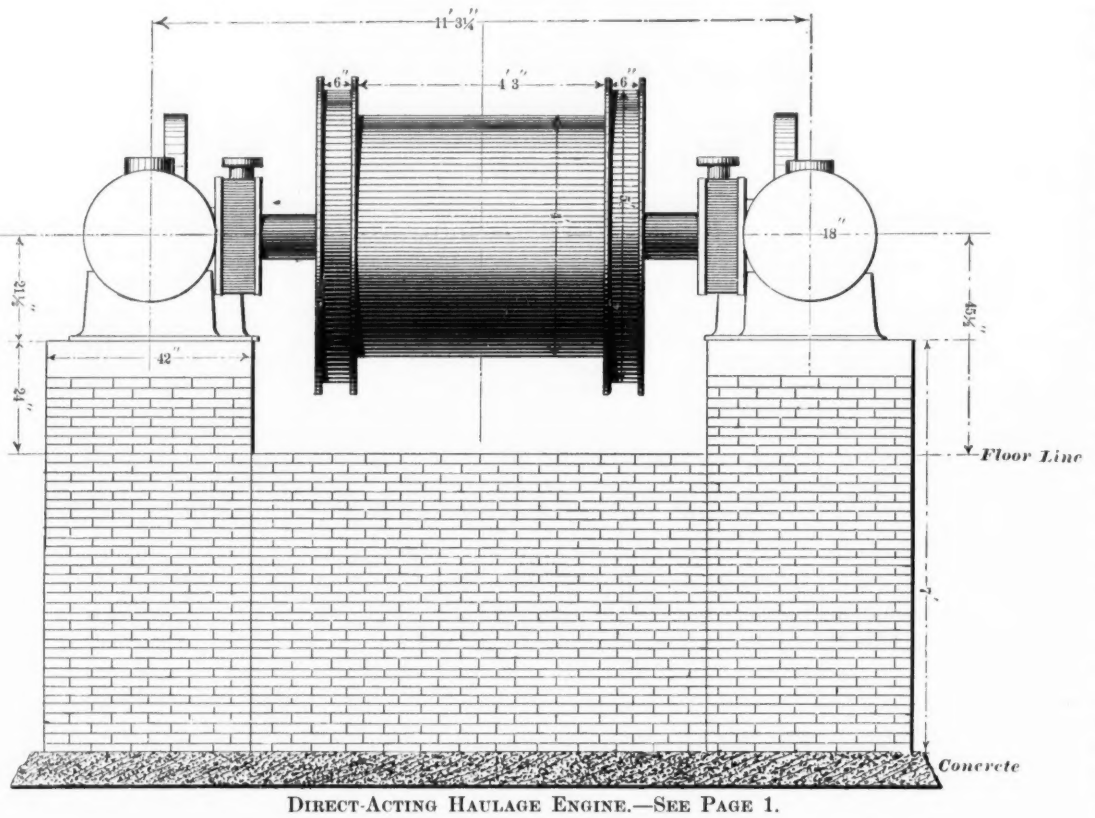
The parties owning the mill had all died, so that there was no testimony beyond this man's bare assertion, with the exception of a small portion of the spinning frame, termed the bolster, which contains the upper bearing on each spindle. This pattern was a small piece of wood about an inch in diameter and six inches in length. The witness testified that he had never made any drawing for this bolster pattern, but had turned it out himself. He stated that it was the identical pattern used in casting all the bolsters for the frame, and that after its use he had kept it in his office, and on leaving the establishment took it with him, this being the only portion of anything relating to the spinning frame which was in existence.

If his statements could have been substan-

tiated, it would have defeated the suit, because it contained salient features which were essential to the patent owned by the plaintiffs. During the cross-examination the lawyer scrutinized the pattern, and, from his knowledge of the practice in foundries, perceived that it had never been used to make a mould. It was of such a form that if it had been placed in the sand it could not have been removed by the fingers, but would have been taken out by a small awl, called a pick, which would have been inserted to remove it, and this pattern bore no evidence whatever of having been scarred by the sharp point of such an instrument; therefore, after the witness had thoroughly identified the pattern as the one used in making the mould for casting the bolsters, the lawyer demanded that the pick-mark should be shown. The witness was confused, and the lawyer again requested him to show the pick-mark. This unexpected technical knowledge on the part of the counsel broke down the witness, who, like all perjurers, had neglected to make his story complete.

The next action in the case was the summoning into the court the foremen of the principal foundries in the vicinity, all of whom asserted that the pattern had never been used in making a mould, as it would have been impossible to remove a pattern of that form from the sand without a pick. A pick had never been used on that pattern, and therefore the pattern had never been used in moulding.

It was the unanticipated information possessed by the lawyer which enabled him to win a very important law-suit. On the other hand, it is doubtful if any one can conceive how many cases of litigation have been lost from the lack of suitable practical knowledge on the part of the counsel. It was a feature of the practice of the late William H. Seward, in his prime, that, whenever he was engaged in a case involving any practical application of mechanical principles, he would go to workmen in that specific line and learn from them all that was possible in regard to the practical features of the work. He carried this practice to such an extent as to introduce new methods in the conduct of patent litigations.



Direct-Acting Haulage Engine.—See Page 1.

Self-Instruction for Young Mechanics.

By Frank Richards.

VI.

I thought that with our last number we had finished the brick question; but it occurs to me that we may still learn a little more from it about isometric projection. Isometric drawing is, or should be, so useful to the mechanic in general, and instruction in it is so meager in the text-books, and in the mechanical papers—even the American Machinist—I never encountered any; so I may venture to help it along a little in my rough and ready way, that is not intended to usurp the function of the professional instructor. It will be remembered that I started about this isometric drawing as useful in the free-hand drawing of machinery; yet I am making so much fuss about it that I am afraid I will frighten the sketcher away. But while we are on any subject it is always proper to say that the more we learn about it, and the more thoroughly we understand it, the more useful it will be to us.

The trouble about the isometric business begins when we go to represent anything other than the rectangular lines. It is just like it is in life, you know. Anybody that is not square is bound to learn what trouble is. Now, suppose that we have two bricks, Fig. 1, one lying flat and the other one tipped over against the end of the first at an angle of 45°, the front edges of both bricks being in the same plane; that is, if you laid a straight-edge against the front edge of both bricks, and in more than one direction, it would always touch and coincide with both. (This is a complete scientific definition, just disguised enough for me to get it into anybody without frightening them.) Now, none of the lines defining the outline of the front edge of the inclined brick, nor those at the back edge parallel to them, will be isometric lines, and we must find some way of getting at both the length and direction of them. The remaining lines of the end will be isometric lines, and will be parallel to the end lines of the other brick. When we get the location of the angles from which these end lines start, we can draw them to the correct length, according to the scale of the drawing. All these drawings of the brick I make to scale, and I call the dimensions of the brick 8″x4″ x2½″, and the scale is ¼. In Fig. 2 we prolong the base line of the under brick as far as seems necessary, and we make the isometric drawing of the under brick, Fig. 3, and prolong the base line of that, also. Then in Fig. 2 we measure off the distance, *a b*, and mark the point, *b*, in Fig. 3. As the angle in this case happens to be 45°, and as the height of the under brick is 2½″, we know that *a b* will be 2½″. Then a line drawn from *b*, and just touching *c*, will be the first line of our other brick; but we don't know the length of it. In Fig. 2 we let fall the perpendicular *d e*, which gives us the distance *e a*. Then measuring the distance *e a* in Fig. 3, we raise a perpendicular to the height *e d* obtained from Fig. 2. Then *d* will give us the length of *d b*, which we need not have drawn until now. In the same manner we may obtain either the point *f* or the point *i*, say *f*, and draw *d f*; then the other two sides *f i* and *i b* may be drawn parallel to *d b* and *d f*, and we have the edge complete. *f k* and *d l* being isometric lines, we may draw them at the required angle, and to the length according to our scale, and then drawing *k l* will finish the whole job.

A peculiar property of the isometric projection is brought out by the angle we in this case have assumed for the inclination of the brick. The angle being 45°, but two of the six faces of the brick appear. This could only occur at this precise angle. If the brick were tipped down more, so that the angle with the base line became more acute, the upper face of the brick would begin to show, and if the brick were tipped up so that the base angle became greater, we would begin to see the under face of the brick.

Another peculiarity that the use of the angle 45° brings to our attention, is the relation of the line *f i* to *k f*, and of *d b* to *l d*. That they should be in a straight line is, indeed, involved in what we were thinking of in the last paragraph—the fact that at this angle of inclination the upper and under faces of the brick are both invisible, and those faces being planes, and coincident with the lines extending to the eye of the observer, the entire visible boundary of either face must be one straight line. You can take anything with a perfectly flat surface, no matter what the shape of its outline, round, square, triangular or irregular, and tip it up until the face just disappears from sight, and all the edge of that surface that you can see will be a straight line. But the queer thing about our brick is, that one part of the straight line is an isometric line, and another part of the same line is not. *f k* and *d l* are true isometric lines. Their direction is correct, and their length agrees with the scale of the drawing. But *f i* and *d b* are not isometric lines. Any one can see how they are for length, without taking the trouble to measure anything. *d b* should be of the same length as *c m*, but it is evidently shorter than that. So, too, *i b* should be of the same length as *c a*, but any one can see that it is longer.

To show what queer capers the isometric drawing will cut with an object, I have taken the same brick and slid it along and tipped it up against the near end of the under brick, instead of the far end, and at the same angle, 45°, as before. It is drawn correctly according to the same scale as Fig. 3. The distortions of dimensions, it will be noticed, are here reversed. The brick that was too short in Fig. 3, is now too long, and where it was too thick in Fig. 3, it is now too thin. In an isometric drawing, then, to have a line true to scale, it is not enough that it should be parallel to one of the three isometric lines. We must also know that the line represented stands in the object in one of the three rectangular directions that the isometric lines represent. We know that the front outlines of our leaning bricks were, at 45°, equidistant from the two, and, consequently, as wrong as they could be in that plane. It is the same with imaginary lines as with actual lines. Let me call attention to the vertical dotted line marked *x*. It is of the same length in all the figures, and in the isometric projections it is a true isometric line, and is correct to scale in length, except that in the thin brick, Fig. 5, it is apparently a little longer than in the thick brick, Fig. 3; but that is only because I am not the most accurate draftsman in the world.

It is proper, also, to call attention to the angles in isometric drawing. As a general rule, we may say that they are always wrong. They are not, in the isometric drawing, the same as in the object represented. We have been representing our brick as tipped over at 45°; but that is not the angle in the drawing. And, curiously enough, the corners of the brick itself, that is tipped over at 45°, are correct. The brick being wrong, its angles are right. But in the under brick, which we assume to lie on level ground, none of its angles are right angles. If we ever become expert enough in isometric drawing to dare to tackle circular work, we may learn more of how angles are squashed and jammed out of shape by isometric projection.

From all these things we may infer that an isometric drawing is fearfully and wonderfully made. It is not a thing to be trifled with. As a working drawing in a shop it wouldn't do for an ignoramus to try to measure it anywhere. For the working measures of parts he must follow implicitly those that have been written in by competent and responsible persons, and stray not either to the right or to the left. I have no expectation that isometric drawing will be generally adopted for working drawings, and I do not advocate it; but I do know that it would enable many a workman to get an idea of the

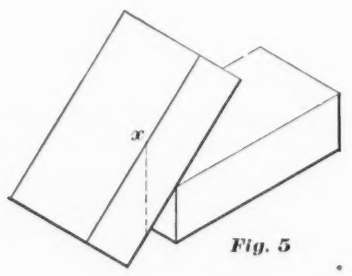


Fig. 5

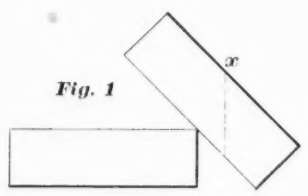


Fig. 1

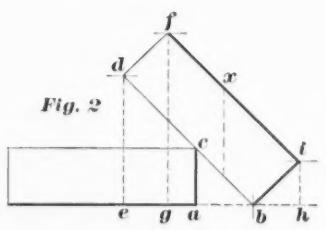


Fig. 2

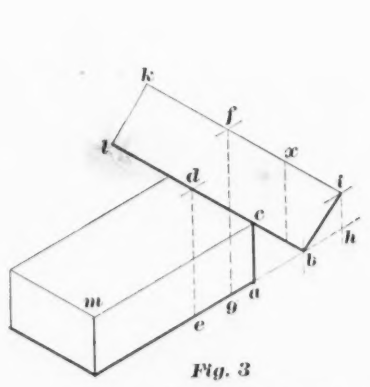


Fig. 3

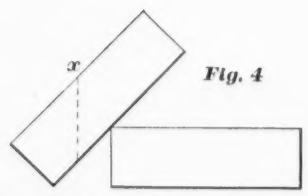


Fig. 4

Self-Instruction for Young Mechanics.

shape of a piece, and of how the different pieces of a machine are related. Like everything else, it is valuable in its place, and would be more generally used if mechanics, and especially young mechanics, would take the trouble to get the hang of it.

Improved Bolt Cutter.

We give with this a perspective view, and some detail cuts, showing the construction of an improved bolt cutter made by the National Machinery Co., Tiffin, Ohio.

The improvements consist chiefly in the mechanism for opening and closing the head, which may be done either automatically or by hand; and in the method employed for centering the jaws.

Above the forward main spindle bearing is fixed a bracket to which is pivoted the ring lever designated by the letter *H*, Fig. 1. This ring carries blocks at the point 2, which engage with a sliding ring on the head, and is moved back and forth at the bottom by means of the link *F*, which connects with a short lever arm which is on the shaft C_4. The rod *R*, having the spiral spring at one end, is also connected with the ring *H*, and tends constantly to draw it to the left and open the head.

When the parts are in the position shown by the full lines, the three centers joining the lower end of the ring *H*, the link *F* and the short lever arm are in line, and the parts are thereby locked in position. The lever *L* is attached to the shaft C_4, and carries upon its side a block *D'*, through which passes the rod *M*, carrying two tappet collars *O* and *P*. This rod is attached to the carriage, and, as it moves up, the collar *P* comes in contact with the block *D*, and moves the lever *L* to the left. As soon as sufficient movement takes place to raise the end of the link *F* a short distance, the coiled spring draws the lever rapidly backwards, and opens the head. The set screw *S* is adjusted to prevent the lever *L* moving too far to the right, or beyond the point at which the locking takes place. When the carriage is drawn back, the collar *O* acts to close the head. By moving the collars out of the way, the head can be opened and closed by hand.

The method of centering the jaws is shown at Fig. 2, where a right and left hand screw is journaled in a sleeve, which has two spiral slots cut upon its outer surface, into one of which projects a short pin, and into the other a screw which bears upon the bottom of the slot. By loosening the screw, the sleeve can be rotated slightly either way, and thus the screw and both jaws moved bodily one way or the other to the center, after which the screw can be tightened to hold them.

It will be seen that the machine has all the other necessary conveniences for operating, and is very substantially built.

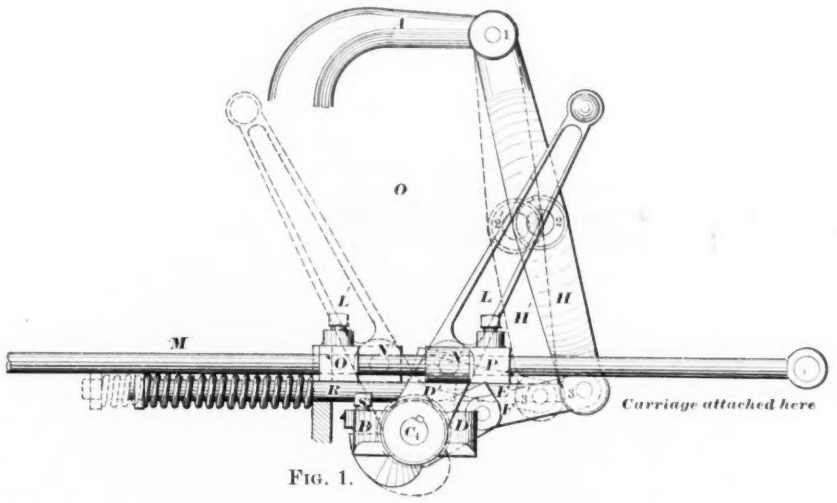


FIG. 1.

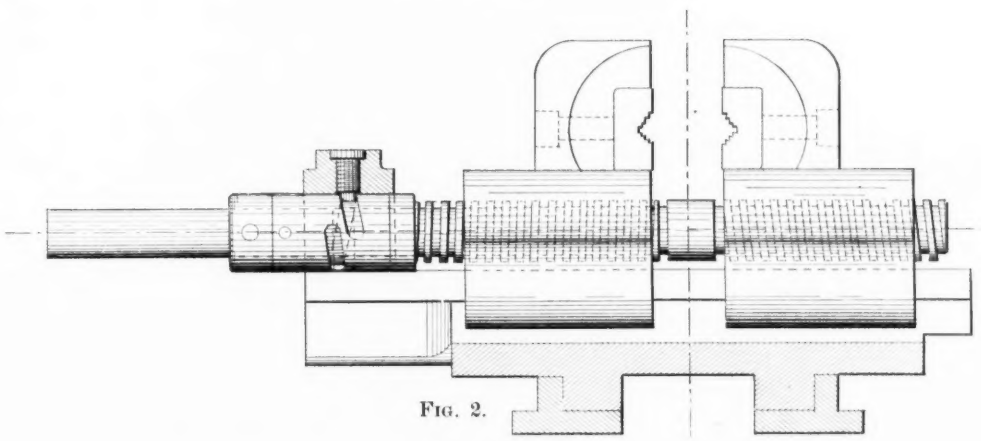
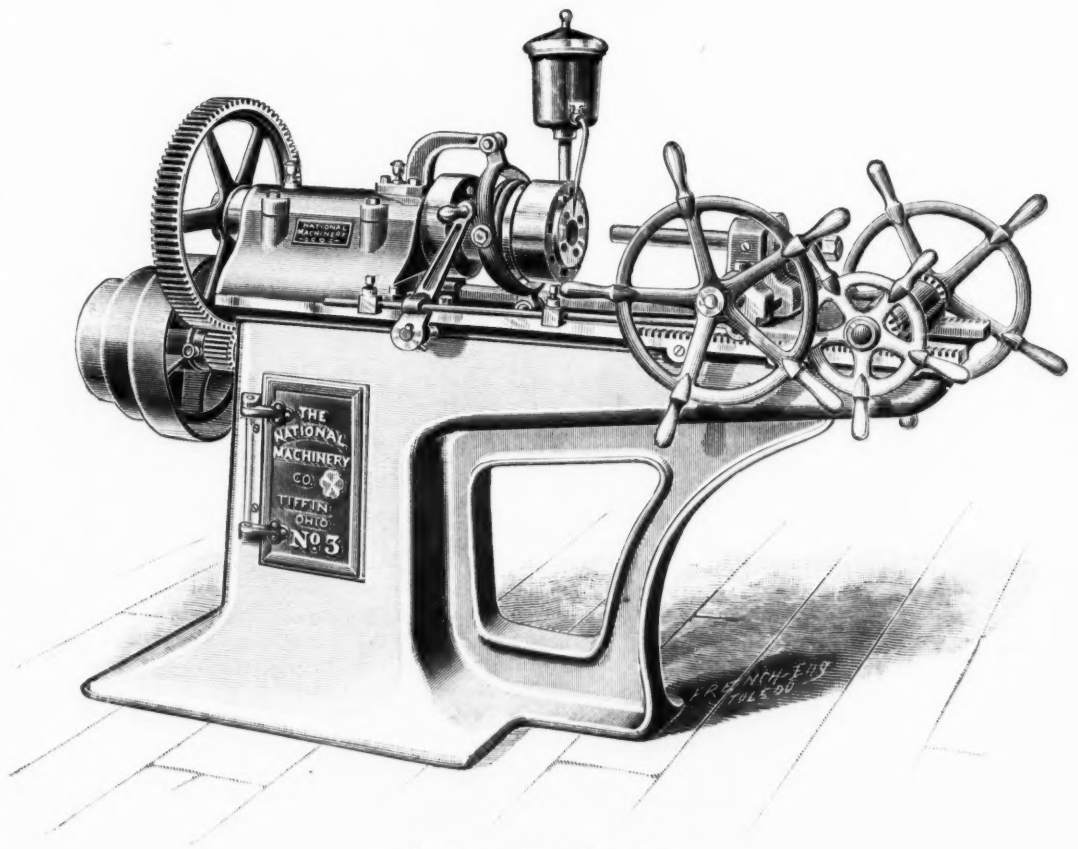


FIG. 2.



IMPROVED BOLT CUTTER.

The dynamite cruiser, Vesuvius, seems to be a job of honor all the way through. She exceeded the requirements and expectations on her trial trip, and now Captain Zalinski is confident that the fire of her guns will be twice as rapid as called for in the contract. It is probable that another vessel, similar to the Vesuvius, will soon be contracted for.

A correspondent has trouble with air leaks around the exhaust valve stems of a Harris-Corliss engine, when it is run condensing. He has tried various means to stop the leaks, but none of them are satisfactory, as they cause too much friction. Can any of our readers help him?

Compound Locomotives.

Angus Sinclair read an interesting and instructive paper on compound locomotives at the last meeting of the New England Railway Club, of which the following is a brief abstract:

The paper begins with reference to the interest in the subject through the importation of the Webb compound locomotive, by the Pennsylvania Railroad Company. Compound locomotives, the author says, have been worked successfully on European railways for upwards of twelve years, but practically nothing has been done in this country to test the system. This is attributed to the antipathy of locomotive designers to change of form likely to increase complication of parts, and to the fact that no heavy pressure has been put upon American railroad mechanical officials to effect rigid economy in the use of fuel. The fact that compound engines for other purposes did not come into use sooner in this country was owing to the prejudice in favor of the typical forms of American engines.

Reference was made to the great economy in the use of steam by compounding, as introduced by John Elder, of Glasgow, Scotland. This had made the high speed now common in marine service possible. The change to compounding, however, had been made against the opposition of engineers of high repute.

From compounding marine engines the principle was adopted in stationary engine practice, and finally, within the past ten years, about six hundred compound locomotives had been built, and were now at work.

A fundamental principle in steam engineering was the conversion of as much as possible of the heat of the steam into useful work, and there was difficulty in the case of the locomotive in working steam expansively to the extent that was desirable.

Referring to the evils of condensation and re-evaporation in the cylinder of simple engines, the author concluded that few locomotives in use lost less than 20 per cent. of the steam through this cause. Locomotive cylinders were more exposed to refrigerating influences than the cylinders of any other form of engine, yet very little attention was bestowed upon protecting them. Less loss resulted from cylinder condensation in compound engines, because the extremes of temperature in the cylinders were less.

The business of operating railroads in Europe was done on a close margin of profit, and the officers in charge of the mechanical department of a railroad were under strong pressure to effect saving wherever possible. As early as 1850, John Nicholson, an engine driver on the Great Eastern Railway, designed a compound locomotive, and several were built and used for a few years. The proportions of the cylinders of his locomotives were as good as anything produced since, and no reason was seen for the abandonment of the system at that time, except that no influential railroad officer was interested in the matter.

Mr. Mallet, a French engineer, deserves the credit for making the application of compounding to locomotives a success. He advocated compounding so convincingly that in 1876 the Bayonne & Biarritz Railway Company had two locomotives built after his designs, and they proved a success. Mallet's system, with a few variations, had been applied elsewhere.

Probably 15 per cent. would be a fair average of the saving by compounding locomotives, as expressed by those who have had experience in the matter. Compounding itself did not bring about all the saving; a considerable share must be attributed to the higher pressure of steam carried; still, compounding provided the means for getting more work out of high-pressure steam than could be done with a simple engine where the facilities for expansive working were so limited.

There were other incidental advantages due to compounding. Owing to the steam distribution, there was superior rotative effect, the average unbalanced pressure on the valves and pistons was less in a compound than in a simple engine, so that leakage of steam would be diminished. As the compound engine used less steam than a single engine, the boiler did not have to be urged so hard, consequently a larger exhaust opening could be used, and as that meant slower velocity of fuel gases, fewer sparks would be drawn through the tubes.

On the other hand, a compound locomotive was more expensive to build than a simple one. If a boiler had to be built to carry a working pressure of nearly 200 lbs., the original cost and the expense of repairs would be increased. The additional mechanism of a compound locomotive must increase the expense of maintenance, and the risk of failure or delay through breakage or the parts getting out of order was greater.

The ordinary American locomotive could be converted into a compound with very little expense or structural change, but the present system of operating the train service in this country would make a compound locomotive oe any existing type unsuitable for doing thf work. Economy of fuel in operating locomotives is held to be of much less importance than that of having an engine that will pull the last car possible out of a yard or over a grade. Our stations and stopping places were so numerous that, unless a locomotive was capable of exerting her full power the moment the throttle was opened, she would lose time on passenger trains, delay traffic on freight trains, and soon become a reproach and a nuisance. The most successful com-

pounds were very powerful engines when working the steam expansively, but they were incapable of exerting in starting a train, or during a slow pull, the full tractive force that the adhesion admits of.

Mr. Sinclair concludes as follows:

"If compound locomotives are ever to be used successfully in this country, they will have to be designed specially to meet the requirements of our train service. Mr. A. N. Towne, general manager of the Southern Pacific, lately made a statement to the effect that coal for the company's locomotives costs them $6 a ton in San Francisco, and that they have to haul it in some cases thousands of miles to the divisions where the fuel is used. The enormous saving that would result to the Southern Pacific Company and other roads from a reduction of 15 per cent. of the coal consumed will some day bring about a fair trial of compound locomotives in this country. When that time comes, an important element of success will be due to the engineer who designs a compound locomotive with simple, efficient and durable appliances for transforming the engine into direct-acting or compound-acting, at the will of the man in charge. American inventive genius ought to be equal to supplying this demand."

Modern Locomotive Construction.

By J. G. A. Meyer.

EIGHTY-NINTH PAPER.

Generally, the pins in the knuckle joints are made of wrought-iron, and are case-hardened. Iron is to be preferred to steel, as iron pins, particularly when their form is like that shown in Fig. 491, are not as liable to break off in the shank as steel ones. In many engines these pins work in wrought-iron bushings case-hardened; in a few instances they work in brass bearings, arranged as shown in Figs. 441, 445, 75th paper.

The knuckle joint pins should be prevented from turning in their outer bearings; for this purpose dowel pins are inserted, as shown at *p*, Fig. 491.

TABLE A.

Dimensions of knuckle joint pins for mogul, ten-wheeled and consolidation engines, suitable for maximum steam pressures on pistons varying from 120 to 140 pounds per square inch.

Diameter of Cylinder.	Diameter of Pin.	Length of Pin.
11	1 5/8 inches.	1 1/4 inches.
12	1 5/8 "	1 3/8 "
13	1 7/8 "	1 7-16 "
14	2 "	1 9-16 "
15	2 1/8 "	1 11-16 "
16	2 1/4 "	1 3/4 "
17	2 3/8 "	1 7/8 "
18	2 1/2 "	2 "
19	2 5/8 "	2 1/8 "
20	2 7/8 "	2 1/4 "
21	3 "	2 3/8 "
22	3 1/8 "	2 1/2 "

TABLE B.

Dimensions of knuckle joint pins for mogul, ten-wheeled and consolidation engines, suitable for maximum steam pressures on pistons varying from 140 to 160 pounds per square inch.

Diameter of Cylinder.	Diameter of Pin.	Length of Pin.
11	1 5/8 inches.	1 5-16 inches.
12	1 3/4 "	1 7-16 "
13	2 "	1 9-16 "
14	2 1/8 "	1 11-16 "
15	2 1/4 "	1 13-16 "
16	2 3/8 "	1 15-16 "
17	2 1/2 "	2 "
18	2 5/8 "	2 1/8 "
19	2 7/8 "	2 1/4 "
20	3 "	2 3/8 "
21	3 1/8 "	2 1/2 "
22	3 1/4 "	2 5/8 "

So long as the side rods remain in perfect alignment, the knuckle joint pins do not rotate in their middle bearings; under other conditions the amount of rotation is very small; hence the liability of heating is not so great as that of the crank-pins; consequently, the pressure per square inch of projected area of a knuckle joint pin can be considerably greater than the pressure per square inch of projected area of a crank-pin. Careful observation seems to indicate that the projected area of a knuckle joint pin may be at once determined from the pressure on the piston, and that for every 7,000 pounds of the maximum steam pressure on the piston, one square inch of projected area should be allowed. Hence, for obtaining the length and diameter of a knuckle joint pin, we have the following rules:

Rule 81.—Divide the total maximum steam pressure on the piston by 7,000; the quotient will be the number of square inches in the projected area of the pin.

Rule 82.—To find the length and diameter of the knuckle joint pin, divide the projected area, as found by Rule 81, by 5, multiply the quotient by 4, and extract the square root of the product; this square root will be the length of the pin. Multiply the length by 1.25; the product will be the diameter of the pin. Fractions less than $\frac{1}{16}$ of an inch are not adopted; hence, if the dimensions found by calculation contain fractions less than $\frac{1}{16}$ of an inch, adopt the nearest value which does not contain anything less than $\frac{1}{16}$ inch.

Example 110.—It is required to find the dimensions of a knuckle joint pin for a consolidation having cylinders 20 inches diameter; maximum steam pressure on the piston, 140 pounds per square inch.

The total maximum pressure on the piston will be

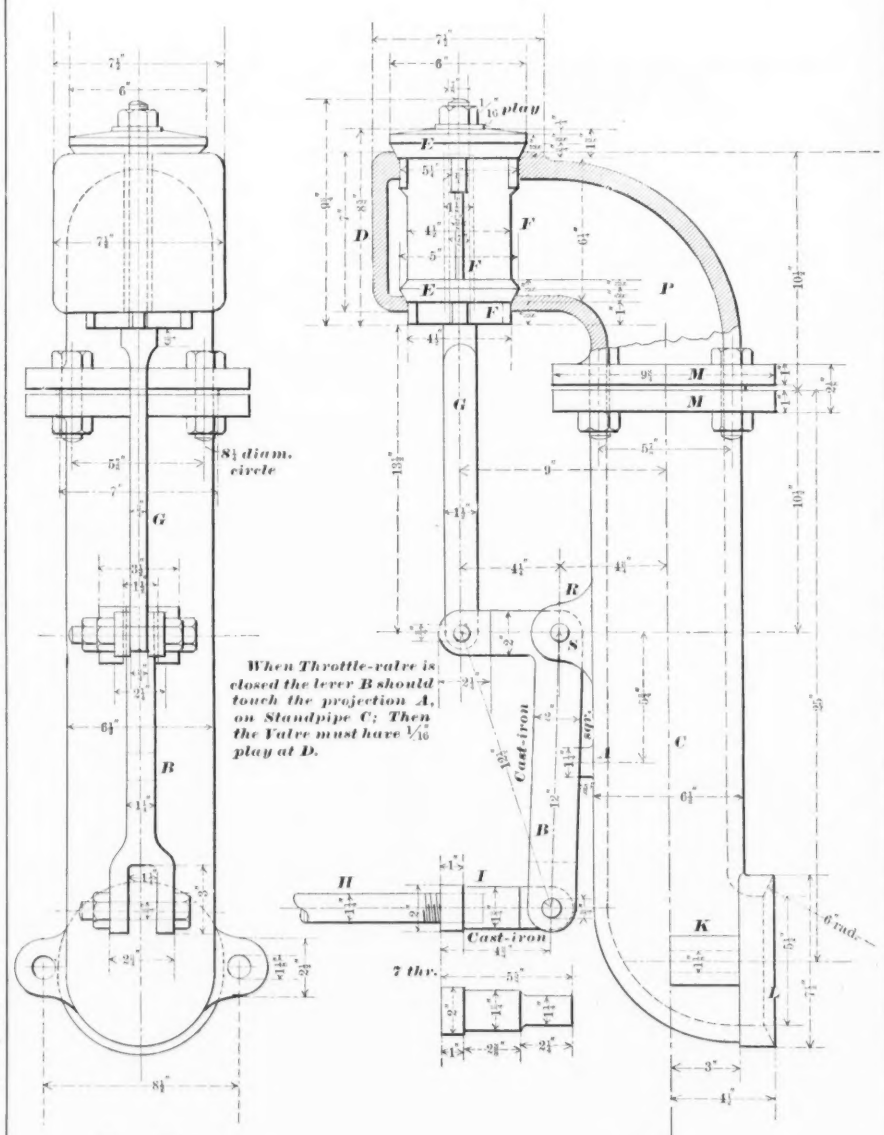

8½ diam. circle
When Throttle-valve is closed the lever B should touch the projection A, on Standpipe C; Then the Valve must have 1/16 play at D.
Cast-iron
Cast-iron
7 thr.
6" rad.

Fig. 492 *Fig. 493*

Modern Locomotive Construction.

$$314.16 \times 140 = 43982.4 \text{ pounds.}$$

According to Rule 81 we have

$$\frac{43982.4}{7000} = 6.28+ \text{ square inches in the projected area.}$$

According to Rule 82 we have

$$\frac{6.28}{5} \times 4 = 5.02+.$$

The square root of 5.02 is $\sqrt{5.02} = 2.24$ inches, which is the length of the pin. And the diameter will be

$$2.24 \times 1.25 = 2.80 \text{ inches.}$$

Adopting the nearest values which do not contain anything less than $\frac{1}{16}$ inch, we have for the length, 2¼ inches, and for the diameter, 2⅞ inches. By the term "length," we mean only that portion of the pin which is covered by the bushing, or the brass bearing, in which it works. An increase in the steam pressure of 10 pounds per square inch of piston will only slightly increase the dimensions of the pins; hence, in the following tables we have given only one set of dimensions for these pins, suitable for steam pressures varying from 120 to 140 pounds per square inch of piston, and another set for steam pressures varying from 140 to 160 pounds per square inch.

THROTTLE VALVES.

Throttle valves are occasionally placed in the smoke-box, close to the front flue sheet; when placed there, the throttle valve is simply a plain slide, arranged so as to open or close rectangular ports, which lead the steam into the steam pipes; but the general practice is to place the throttle valve inside of the dome; and for such cases a double poppet valve is used. The design of this valve, and that of the throttle pipe, is shown in Figs. 492 and 493. The throttle valve consists of two disks, *E E*, cast to three or four wings, *F F*. The upper portion of each one of these disks is generally bounded by a cylindrical surface, and the lower portion, by a conical surface; the conical portions of the disks fit into seats of corresponding form in the throttle pipe. The angle formed by an element of this conical surface and the axis of the valve is often equal to 45 degrees, and sometimes it is less, as shown in our illustrations. Necessity demands a larger diameter for the upper disk than that of the lower one, so as to enable us to pass the lower valve through the upper opening. A difference in the diameters of these disks is in nowise objectionable; in fact, such is desirable and advantageous for the following reason: The throttle pipe is surrounded by the steam in the boiler, and when the valve is closed a greater pressure will be on the upper disk than on the lower one, because the former exposes a larger area to the steam pressure than the latter. Under these conditions the valve has a tendency to remain closed when steam is shut off, which is of great importance, as this reduces the liability of engines running away, and thus avoids serious accidents.

The throttle valve is placed in a vertical position, and as high in the dome as possible, leaving between it and the dome-cover sufficient room only for raising the valve so as to obtain around it the necessary amount of opening for the admission of steam. The vertical distance through which the valve must be raised rarely exceeds 1¼ inch; often it is less.

The valve is made to fit the valve stem *G* quite easy, so as to give the valve ample freedom to come in contact throughout with its seat. The stem *G* connects to the bell crank *B*, and the latter connects to the valve rod *H*, which passes through the end of the boiler and connects to the throttle lever. The valve stem *G* is always made of wrought-iron; the bell crank *B* is sometimes made of cast-iron, frequently of wrought-iron. The valve rod *H* is usually a plain, round wrought-iron bar, with brass, cast or wrought-iron ends *I* screwed on to it.

The throttle pipe, sometimes called the stand pipe, is occasionally made in two pieces, *P* and *C*, as shown in Fig. 493; and in many engines it is made in one piece. When made in two pieces, the joint between the flanges *M M* should be a ground one. This design of throttle pipe (that is, one made in two pieces,) is generally used for a dome, having a portion of its top riveted to the dome sheet, leaving a comparatively small opening for a man to enter the dome for the purpose of making the connections between the throttle and dry pipes, that between the bell crank and throttle rod, and others. In a dome with a small opening at top these connections cannot be conveniently made, and in some cases it is impossible to make them, with the throttle valve in position; hence the pipe is made in two pieces, so that everything can be properly and securely connected, before the upper portion *P*, containing the throttle valve, is placed in position. For domes whose whole top can be removed, throttle pipes made in one piece are suitable. Throttle pipes are always made of cast-iron, and therefore the throttle valves should also be made of the same metal, so as to obtain an equal rate of expansion in the valve and the pipe, and thereby prevent leakage. It is on account of the difference in the rate of expansion of the different metals, that brass valves in cast-iron pipes have proved to be a failure. Even cast-iron valves will expand lengthways a trifle more than the pipe, and this fact should not be overlooked in fitting the valve to its seat. In order to obtain a steam-tight joint, the valve is ground on its seat, until a perfect fit between both the upper and lower disks and their seats has been obtained; the emery should then be wiped off the upper disk and its seat, and a few extra turns given to the valves, so as to only slightly ease the fit between its lower disk and seat; fitting the valve in this manner will generally secure a steam-tight throttle when the engine is under steam.

A New Use for a Noisy Engine.

On an important thoroughfare in New York, just back of the window glass in a store, is a steam-engine used for grinding coffee. The engine is a rather antiquated affair, large enough to serve a half-dozen such purposes as it serves. Whether or not it does its work of pulverizing coffee in a satisfactory manner is still an open question, but as a producer of noise it is an unqualified success. There isn't the remotest danger of any one not hopelessly deaf passing that store without having his or her attention called to that steam-engine, and incidentally to the fact that coffee and tea are sold inside. The writer has passed it a good many times, and just about as often has stopped to speculate upon the peculiarity of its rhythmic metallic clang. It is a study in acoustics, if not in mechanics. It don't pound; it appears to lack energy to do that. It simply rattles around in a manner entirely unique, but not patented, because indescribable. Finally, he was rash enough to inquire of some one, who looked as if he might be the engineer—for about three minutes a day—why the effort necessary to get the component parts a little nearer together, with a view to modifying the noise, was not made. Then it was that the inquirer learned something. "Why," said the presumed engineer, "you don't appear to know much about selling coffee, and tea, and such like commodities. If that engine run quietly, you, and thousands of others, would never have seen it, and never

have known what we sell. When that engine goes to pieces, we want another just like it, only more so, if possible. It beats the little electric tap out of sight." The fellow who had been doing the inquiring left, uncertain whether he had been interviewing the engineer or the proprietor.

Hussey's Back Pressure Valve.

The engraving represents a new back pressure valve which is being placed on the market by the Hussey Re-Heater and Steam Plant Improvement Co., 15 Cortlandt street, New York.

Instead of the lever and weight by which back pressure valves are usually weighted, a spring is used, which can be adjusted by means of the hand-wheel and attached screw to give any amount of back pressure desired.

As will be observed, there is a small dash-pot below the valve, so arranged as to prevent the latter from seating hard.

It is claimed for this valve that it is more compact than the lever valve, that it is more mechanical in its arrangement, that it will work without the usual clatter and noise, and that the valve disk and seat are not subjected to a hammering action, and hence will last much longer than those of the lever valve.

A New Stub End.

We give herewith a perspective and a sectional cut, showing a new stub end furnished to engine and other machine builders who make use of connecting rods. In making this stub end the rod is first provided with a simple eye, having a straight hole through it, and being flattened on both sides. Into this eye fit closely the two nuts 3, 3, which are threaded nearly all the way through. Into the threads of both these nuts fit the sleeve (4), which can be moved one way or the other by slacking one of the nuts and tightening the other.

The wrist-pin is made taper $1\frac{1}{2}''$ to the foot, and the sleeve (4) made to fit it. Wear can thus be taken up without changing the length of the rod until the sleeve comes in contact with the bottom of the nut, when it can be repeatedly faced off, and, when too short, easily replaced.

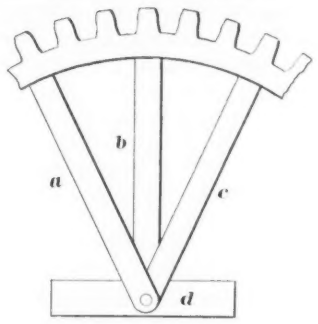
The nuts and the sleeve are made of a composition selected with reference to its wearing qualities.

They are made in a great variety of sizes, up to $3\frac{1}{4}''$ length at *C*, and $2\frac{7}{16}''$ diameter at *F*, by the T. C. Dill Machine Co., Philadelphia, Pa.

It is probable that the sash and door trade will be immensely developed on the north Pacific coast during the coming five years. The cedar of that region is admirably adapted to the manufacture of such goods. It is wide, clear and easily worked, but its chief recommendation for sash and doors is its integrity when put in place. It never warps, and shrinks and swells but little. It is now largely used for the home demand, and manufacturers already have their minds set on extending their markets so as to reach remoter parts of the country. There is no reason why their anticipations should not be realized. Sash and doors are mill products that can be shipped long distances at a profit, and an energetic pushing would place north Pacific factory output in any part of the country.—*Northwestern Lumberman.*

Almost anything seems possible in these days. The old story of the prison convict who gravely informed a philanthropic inquirer that he was in for stealing a saw mill, but should have got away with the mill all right had he not gone back for the dam and got caught, is very nearly matched by a recent actual occurrence. The enterprising owners of a saw mill near the Canadian line wrestled with a heavy incumbrance on the property by loading mill and machinery on two barges and towing the whole into Canadian waters.

A patent has been granted to a Somerville (Mass.) man for a device for mixing liquid and powdered substances—chalk and milk, we presume.



Casting Circular Toothed Segments.

By W. H. Booth.

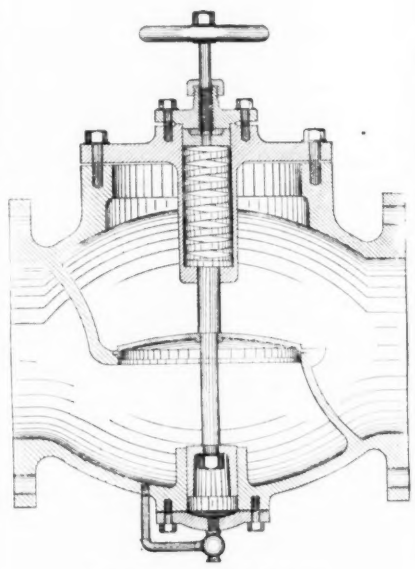
There is a particular point to be observed in the casting of circular toothed segments for large wheels. A large wheel of 20 feet diameter will be cast in ten segments of 15 or 20 teeth each. If each segment be carefully measured, it will be found that the end two or three teeth are of wrong pitch: they lean away from the middle of the segment sometimes quite considerably. I have myself dressed off $\frac{1}{16}''$ to $\frac{1}{8}''$ from teeth of 5 inch pitch.

Often only the end tooth suffers; the next tooth, if affected, is only slightly so, and the third hardly appreciably so. The cause of this irregularity is variously stated. Some moulders and pattern makers will tell you that the ramming of the sand between the teeth has the effect of altering the radius of curvature of the segment and throwing the end teeth outwards. In other words, this explanation would imply that our segments for a 20-foot wheel of 200 teeth are really only of a radius suitable for say a 19-foot wheel of 190 teeth.

Others again will explain the discrepancy by saying that, as the casting contracts in the sand, the body of the segment shortens and draws away from the end teeth to a slight extent, and these, being still soft, are bent over by the contraction of the body of the casting. This explanation will be less acceptable to those who believe that cast-iron expands at the moment of solidifying. The fault is very irregular; a first-class moulder whom I once knew, and who was very successful in obtaining very accurate segments, informed me that he overcame the difficulty by firmly bedding in the sand at each end of the pattern a heavy mass of iron. He then rammed up the teeth, beginning from the end teeth and proceeding towards the middle of the segment. He claimed this proceeding kept the pattern from being deformed by the pressure of the rammed sand teeth, and, as judged by results, there was truth in his reasoning, for the peculiar distortion of the end tooth or two would be much less, or entirely absent, in this man's castings. When large wheels are built up of segments, great care is needed in pitching these at the points of junction, for it is easy to see that, as the end teeth of each contiguous pair of segments are distorted in opposite directions, there is a sudden transference as the junction is passed, from a slack to a tight pitch.

One advantage of the moulding machine for large gears is that a complete circle or wheel rim can be cast. The disadvantage of this, however, is that there is a greater chance of waste arising from failure of some of the first moulded teeth, especially when the wheel is large or of small pitch.

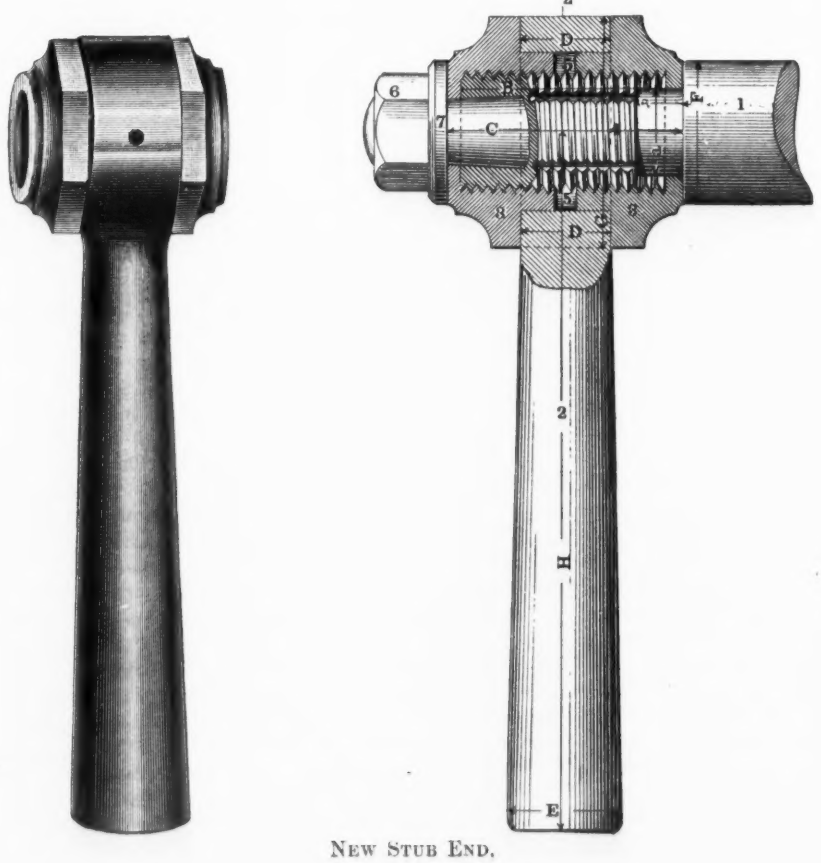
Many foundries, however, have no large moulding machine, and moulding machines are not specially noted for producing accurately pitched gears. I would suggest to those moulders, and to foundries generally who really desire to cast gear segments with accuracy, and avoid entirely the distortion of the endmost tooth or teeth, that they should



Back Pressure Valve.

adopt the following plan. I have not myself tried it, but have reason to believe it will answer.

To the mould of segment as shown in sketch, I would add two or three radial channels *a b c*, which should be moulded with a plain bar and communicate with a cross channel, *d*. The segment, when cast, would then be simply part of a wheel rim with attached arms. In solidifying and cooling in the mould, the contraction of the bars or arms *a b c* would draw the segment bodily towards the center of the circle of which it forms a part. The circumferential contraction would take place as before, but would not now have the effect of distorting the end teeth, for the reason that the segment, as it contracted in length, would be simultaneously drawn into a position suitable for that length. Of course the bars *a b c d* would be only so much pig metal, and be returned to the furnace. They should, of course, be proportioned so as to have a proper rate of contraction not slower than that of the segment itself. Precautions to allow the contraction of the arms, to have full effect on the segment, will suggest themselves to the moulder in the way of rendering the resistance of the mould as small as consistent with holding the molten metal. On such points I need not further enlarge, except to say that, as the mischief of distortion is probably effected at and soon after the point of solidification, when the teeth are easily bent out of the true radial line, it will be in the direction of good practice to free the teeth of rammed sand as soon as practicable after solidity is gained. They can be covered again with loose sand to prevent too rapid cooling, but if made free, and the top weights removed, the temporary arms may be cut away any time; at once, if desired. The small extra expense in moulding and casting such arms ought to be repaid in accuracy and satisfaction at good work. Of course the bar *d* is simply inserted as an anchor against which the arms pull, or these might be cast round a stake driven down at the center of the circle. The same principle of controlling the method and direction of contraction may be employed in other parallel cases of irregular shaped castings, and will be found useful. I believe it to be the only really correct method to insure accuracy in gear segments.



New Stub End.

LETTERS FROM PRACTICAL MEN.

Wax Corners.

Editor American Machinist:

I am rather surprised at the remarks of C. R. about the wax press. I am not pecuniarily interested in the press, but I know about it, and believe in it. The use of its product for the filling in of sharp corners, *that would not otherwise be filled*, is not only to be commended and encouraged, but should be insisted upon as a matter of considerable importance. It has nothing to do with black varnish, or any other subterfuge of dishonesty.

Frank Richards.

Friction of Line Shafting.

Editor American Machinist:

I noticed in the American Machinist for April 4, your answer to a correspondent, on estimating the probable power required for line shafting. Your answer, assuming a "coefficient of friction" of .05, or 5 per cent., is probably as correct as it is possible to state it. I have found it up to .075, and down as low as .033. For shafting in good order, and well lubricated, .05 is undoubtedly safe.

In regard to the power required when driving belts to machines, on loose pulleys, you will be very close to truth if you simply double the coefficient, or make it .10, or 10 %.

The following records are from my note-books:

About 100 ft. $2\frac{1}{4}$ shaft, 240 R. P. M = .842 H. P. Same with belts on loose pulleys, 1.786 H. P.

In another test, fewer machines, similar shaft, alone, 1.012 H. P., same with belts on loose pulleys, 1.678 H. P.

Again: About 50 ft. 2″ shaft, 200 R. P. M., .214 H. P., same with belts on loose pulleys, .438 H. P.

My son, Mr. Wm. O. Webber, made a year since a very full test of the power used by the Amory Mill, Manchester, N. H., computing the shafting in gross, from the amount of water discharged by the turbines, whose coefficient of effect was very closely known, and his results gave shafting only 159.18 H. P.

Shafting with belts on loose pulleys. } 280.25 H. P.

The shafting alone was equal to about 11 per cent. of the dynamometer tests of the

power required for the machines in the mill = 1,437 H. P. The belts and loose pulleys add 9 per cent. to this, showing 20 per cent. if the belts and loose pulleys were counted as belonging to the shafting, which is the point I denied at the Boston meeting of the A. S. M. E.

These results, however, show that both Mr. Henthorn and myself were correct in our statements from our different points of view, mine being that when a mill was at work the belts were not on the loose pulleys, but formed practically a part of the machine, so far as the consumption of power was concerned.

Samuel Webber.

Drawings for Pattern Makers.

Editor American Machinist:

In your issue of April 4th, Mr. Dingey criticises the plan of making a full size drawing for the pattern maker's use, and a few more remarks in explanation of the plan will perhaps remove some of his objections to it.

Drawings should be made full size for pattern makers in all cases where irregular curves or shapes occur, for the reason that there is no other way to represent such shapes to the pattern maker so he can make them as wanted. Such shapes are determined first by the designer, and it seems curious to suppose, as Mr. Dingey does, that the pattern maker can take a ¼ size drawing and from it make a full size drawing, reproducing such curves more correctly than a professional draftsman could do it. In the matter of the distortion of such curves by shrinkage, even the pattern maker could not insure uniform results, because of the fact that no two castings from the same pattern shrink alike, and the designer must keep that fact in mind, and provide for and expect such variation to occur in the castings, so that, in all but extremely rare cases, if the pattern maker makes the pattern the shape of the curves given him on the drawing, simply prolonging the terminals of such curves enough to allow for shrinkage, the result will be entirely satisfactory to the designer.

As to the matter of figures on the drawing no one knows better what those measurements are than the designer, and if they are put on the pattern maker's drawing it saves him the liability of mistakes in measuring the drawing, and also requires less time to get the dimensions.

Mr. Dingey wants to know what is the use of a full size drawing if the pattern maker is not allowed to measure it? With the same consistency it might be asked what is the use of a pattern maker wanting to measure a drawing where figures are given? After all, Mr. Dingey admits that he thinks it is better for the pattern maker to make the allowance for shrinkage, and that is just what the writer has advocated, and that is the reason for such instructions to pattern makers. If the draftsman was required to make the allowance for finish, shrinkage and draft, why not require him to show the core-prints, loose pieces, core boxes, draw plates and all other details of pattern making? The fact is, the line between the work of the pattern maker and draftsman must be drawn somewhere, and the plan of terminating the draftsman's part of the work when he has furnished the pattern maker with a drawing, showing the size and shape of casting wanted, seems to have advantages over any other plan the writer has seen used.

B. Crank.

Air for a Steam Hammer.

Editor American Machinist:

We think we have something of a novelty that might be of interest to some of your readers. The Eames Vacuum Brake Co. recently built a large blacksmith shop in which were placed one 1,200 lb. and one 800 lb. steam hammer. They were piped to the steam boiler and worked very well; nothing novel about that. But Mr. A. P. Massey, mechanical engineer of the company, who has a sharp eye to the practical as well as the beautiful, reasoned that, as we had plenty of water power, why not run these steam hammers by air? To put the idea to the test, an air compressor was purchased. It was put in position for trial, a storage tank of 150 feet capacity being used. The air was piped to the hammers, about 300 feet away, by a 2″ pipe. It was found that the hammers worked better than with steam; we had no water dripping down or steam blowing from the glands or joints, and everybody is delighted and thinks it a grand success. We run the compressor at less than half speed. As the hammers are not at work all the time the compressor has time to store up power, but the safety valve is blowing off at 80 pounds nearly all the time. A ½″ pipe is trained down from the exhaust to near the edge of the anvil, and blows off every particle of scale, keeping the iron clean.

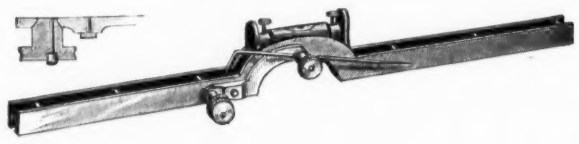
J. J. Bingley.

Watertown, N. Y.

Koopman's Guide Gauge.

The illustration accompanying this is of a tool for machinists' use in lining locomotive guides, and is intended to take the place of the makeshift devices usually employed for the purpose.

It is made of steel, ground and lapped true, and provided with a needle which can be finely adjusted to position by means of the eccentric knurled head shown in section at the left. It is also provided with a good level, which is adjustable, so that the tool can be placed upon the frame of the engine, and the level bubble adjusted to indicate level whether the engine frame is level or not, after which it can be used upon the guides, and



will indicate when they are in the right position. The bent end of the needle can be brought under the "yoke" for getting the center of the crossheads, and the top, bottom and one side of the gauge are clear, so as to lie flat on the guides. The tool measures 13½″ over all, and is made by A. T. Koopman, Chicago, Ill.

Fitchburgh Shop Notes.

At C. H. Brown & Co.'s shops they had just completed and shipped a 14x38 engine, which goes to Paris, and will furnish part of the power in the American section. Almost everything else, they said, had for some days been sacrificed to the one object of getting that engine finished and shipped, and they were just getting things ship-shape again. There are in this shop comparatively few special appliances for getting out work, and they depend mainly upon the standard machine tools and good workmen. One of the largest and most complete lathes for turning and boring fly-wheels is to be seen there among the other heavy tools, and up-stairs are some ingenious appliances in the way of milling machine fixtures. The fixture for milling bolt-heads is an index head which bolts to the platen, and has its spindle provided with split chucks or collets for receiving the turned shanks of the bolts. A turn of a nut at the back tightens them, and a plate is provided with notches for indexing. Instead of straddle-milling, so as to cut two opposite sides of the head at once, as is usual where such jobs are rigged up for, they use only one cutter, and that a regular spiral mill, they finding that where the head must be well finished eventually, the superior surface obtained in this way makes it pay best, notwithstanding the mere milling costs more. A very good use of the slate taper attachment is made in turning the various shapes for the levers, and connections of the valve motion. For this they use a Reed lathe, on which the guide bar of the taper attachment is in the form of an inverted T, over the upward projecting rib of which the sliding block fits. The carriage has two cross slides, the lower one being operated by the taper attachment, when it is in use. This construction has been taken advantage of by Mr. Shepard, the superintendent for the shaping of the irregular forms spoken of. He places a block over the guide bar, which has fastened to its upper surface a piece of sheet steel, one edge of which is the desired shape. A small roller is attached to the lower cross-slide spoken of, and comes in contact with this pattern, and as it is kept in contact all the time by a weight which is arranged to pull the slide towards the back of the lathe all the time, the tool is moved in and out in conformity to the pattern, and its duplicate produced. Of course, a tool must be used having a round nose equal in size to the roller. Very nice work is produced in this way, and at a very small cost, compared with the usual methods.

The shop is a model of neatness and cleanliness, with its ceiled and painted ceilings, and planed iron work-benches, and looks as though mechanics working in it ought to be able to turn out the high grade of work for which it is famous.

The works of the Simonds Rolling Machine Co. are exceedingly interesting to a mechanic, though most of what is to be seen there is very difficult to describe. One who watches the process of forging, or rather rolling, such pieces as steel balls, calks for patent horseshoes, spurs for the boots of lumbermen, track-bolts, etc., and notices the extreme rapidity with which such work is turned out, and the quality of it, is likely to be impressed with the idea that here is a process which has a great future before it, and which will come to be recognized as one of the greatest and most beneficent of inventions.

Two vertical slides face each other in the machine, carrying upon their faces dies of hardened steel. As one slide carrying its die descends, the other rises, and the heated end of a steel bar rolls between them. The faces of these dies are in various shapes, according to the work to be done, and at one passage over the bar a piece, and in some cases two pieces, are reduced to proper shape, and cut off, falling underneath the machine as finished forgings. And not only are they finished as ordinary forgings, but threads formed upon them, which are accurate enough, and in some respects better than any other threads which could be produced for the purpose. Track bolts, for instance, are finished complete, with a thread which is excellent for the purpose; indeed, better in every respect than the threads usually cut by dies upon such work, and the entire bolt, which has been pronounced by railroad men to be the best track-bolt ever produced, is finished from the bar, ready for use, in much less time than is required to simply forge them by any other process. As a sample of the work which can be done, we may mention a piece for which they had just completed the dies, having received a very large order for the pieces. It is a screw of steel 1 1/16″ in length over all, 9/32″ diameter, and having in the middle of its length a collar ½″ diameter and 5/16″ thick. The collar is knurled upon its outer surface, and has square shoulders, without the draft, which would be necessary to give them if they were drop-forged. The threads, which are eighteen per inch, run up full and perfect, clear up to the shoulders on each side, so that a nut could be screwed against them without cutting away any of its threads or chamfering; and on one end the thread is right-hand, and the other left-hand, both ends being neatly and squarely cut off. This piece will be recognized as a difficult one to produce in quantities and at a low cost by any other method. It cannot be produced complete upon the automatic screw machine; and, of course, to forge such a piece had never before been thought of, yet one of these pieces is by this process produced complete at each stroke of the machine, the rate being limited chiefly by the ability of the attendant to heat and handle the bars of steel. In the case of such work as the steel balls, it is in contemplation to feed the bars automatically, passing them through a small furnace kept at just the right temperature to heat them properly before reaching the dies.

An inspection of the machines which were in use before Mr. John J. Grant took hold as superintendent, and a comparison of them with the machines which have been built under his supervision, clearly shows that he has done much to put the enterprise upon a practical basis. The machines do their work without apparent effort, and seem to be all that could be desired in point of simplicity and efficiency. One of the machines is to be exhibited in operation at the Paris exhibition this summer, Mr. Grant's son Robert being at the time of our visit in training for the work of operating it.

The degree of accuracy attained in the grinding and finishing of the hardened steel balls produced is something wonderful, though the machinery for doing the work is quite simple. The larger sizes are placed in a circular groove of *V* section, which is cut into the upper surface of a disk which revolves, while a thin disk of steel presses upon the balls at a point below their tops, and keeps them firmly in place, at the same time causing them to roll.

Then the flat face of an emery wheel is applied to the tops of the balls, and grinds them as they turn. They are afterwards polished by a tumbling process. The smaller ones are not ground by an emery wheel, but are simply put into a groove in a plate, and made to roll as they would if used for a thrust bearing. At the same time oil and emery are applied to do the grinding.

Entirely new machinery is being constructed for this work.

The method of testing and assorting balls is quite ingenious, and infallibly shows the most minute variation in size, and separates those which are either larger or smaller than the desired size. It consists simply of two flat strips of steel about 10″ long, each being beveled off on one side, so as to make that edge quite thin. They are hardened, and this edge ground and lapped true and straight. The strips are fixed side by side with these edges nearest each other, and one-thousandth of an inch closer at one end than the other; this distance being adjustable by a screw. The strips are set in a frame upon an incline, with the widest end of the opening at the bottom. The balls are dropped into the opening at the top, and roll downwards towards the wider end of the opening until they drop through into a box placed to receive them.

The variation in distance between the two edges is of course .0001″ for each inch of length, and the box being two inches wide, balls which are one ten-thousandth inch too large roll past the box, while those which are that much too small drop through before reaching it, while those which drop through into the box are known to be within that limit of variation.

The work is, of course, in its infancy yet, but no one can see it without being strongly impressed by its vast possibilities.

The friends of Mr. S. W. Newton, who has been, until recently, with the Feracute Machine Co., at Bridgeton, N. J., will be interested to know that he is now to be found here, and holds the position of assistant superintendent.

The Putnam Machine Co. were found full of orders, among the other tools in course of construction being eight 36″ lathes for the Washington Navy Yard. They are much the same as their standard lathe of that size, except that they are triple geared, having an internal gear in the face plate. They are equipping a room for the manufacture of universal milling machines.

The shop is noticeable for its good order, cleanliness and good equipment in all departments; but this is especially the case in the engine-room, which is a model, and is evidently presided over by a man who has some pride in his business. Electric signals connect the engine-room with all parts of the establishment.

The Rollstone Machine Co. occupy a building which is remarkable chiefly for its age, it having been erected in 1804. As may be imagined, it is not quite as well adapted to their purpose as a shop might be, and yet it is evident they manage to make things go, and build quite a variety of wood-working

machinery, some of which is very interesting especially as it furnishes the key to the mystery of the production of many of the marvelously cheap articles of wood which we see on every hand, and wonder how they can be produced for the price.

They build a wood-turning lathe, which has mounted upon it a frame, which carries a knife equal in length to the piece to be turned. The frame is hung upon centers at the back in such a manner that the knife can be made to swing downwards in contact with the work. The edge of the knife is a spiral, so that the cut starts in at one end as the knife descends, and passes rapidly along to the other end, when it swings upward again, and the piece is finished. They have an engine lathe specially rigged up for turning these knives, which are mounted upon a frame and caused to oscillate before the lathe tool, which, as it feeds along, is made to travel in conformity to a pattern of steel, which is placed behind the tool block. The knife is thus made upon its outer face the exact shape of the piece to be turned. In operation, a square piece of wood is placed in the lathe, and a gouge passed over it, to take off the corners and the bulk of the stock, after which this knife descends once, returns to its place, and the piece is finished. No matter how intricate the pattern, pieces are finished as quickly as though they were plain; and, of course, each piece is exactly like every other piece.

But perhaps the most remarkable machine to be seen there is one which makes the pieces for the backs of what are known as the Vienna chairs. This is a single piece, which is bent into shape so that it forms both of the back legs of the chair, and also the outside bow of the back. It is at first a straight square piece of wood, eight or nine feet long, smallest in the middle, where it forms the top of the chair-back, and then tapered off again at each end, thus having two swells, and being smallest in the middle and at each end. The piece is too long and slender to be turned satisfactorily by ordinary methods, and considerable trouble had been encountered in making them.

The machine which was finally designed for the purpose has a hollow spindle, through which the piece passes by the action of feed rolls, which are placed at each end. The spindle has a pulley upon it, and is driven by the belt at a high speed. At the entering end are cutters, which make the piece round, and reduce it to a uniform size, somewhat larger than the largest finished size. At the other end of the spindle are cutters, which are mounted in a head in such a way that they are moved to or from the center, making the pieces smaller or larger accordingly. This is accomplished by mounting the knives upon what are, in effect, short levers, which are made to swing in and out by suitable mechanism connected with a roll, which rests upon the top of a steel pattern of the desired shape, which is placed in a chuck prepared for it within the pedestal which supports the machine. This pattern is moved along by gearing, and a rack, which are thrown into action by the spreading apart of the feed rolls; and as soon as the piece has passed through, and the feed rolls approach each other again, the mechanism is released and the pattern automatically returned to its place, ready for another piece. The proportions of the various movements are such that the pattern is much shorter than the piece of work produced; in fact, about one-fourth the length. Though designed primarily for the job mentioned, it can, of course, be used for a variety of similar work, it being necessary only to change the pattern.

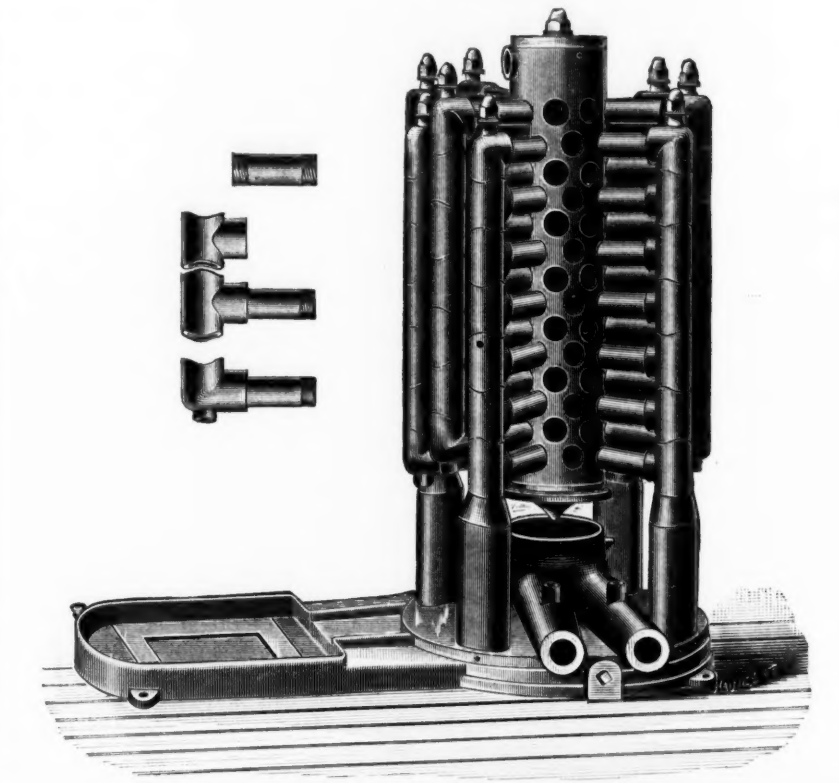
Old as the shops are, there are in them, at present, some pieces of wood which are much older, and have considerable historic interest. They are some pieces of English oak which originally constituted part of the British man-of-war Somerset, one of the largest naval vessels of her time, carrying 84 guns, with 640 men. She has lain under the water off Cape Cod since 1778; and about two years ago, during a severe storm, floated partly to the surface, and almost immediately disappeared again, not, however, before these pieces of oak were secured. They came from near the powder magazine, and are stained by the powder, so that they resemble ebony, being apparently almost as sound as when put into the ship.

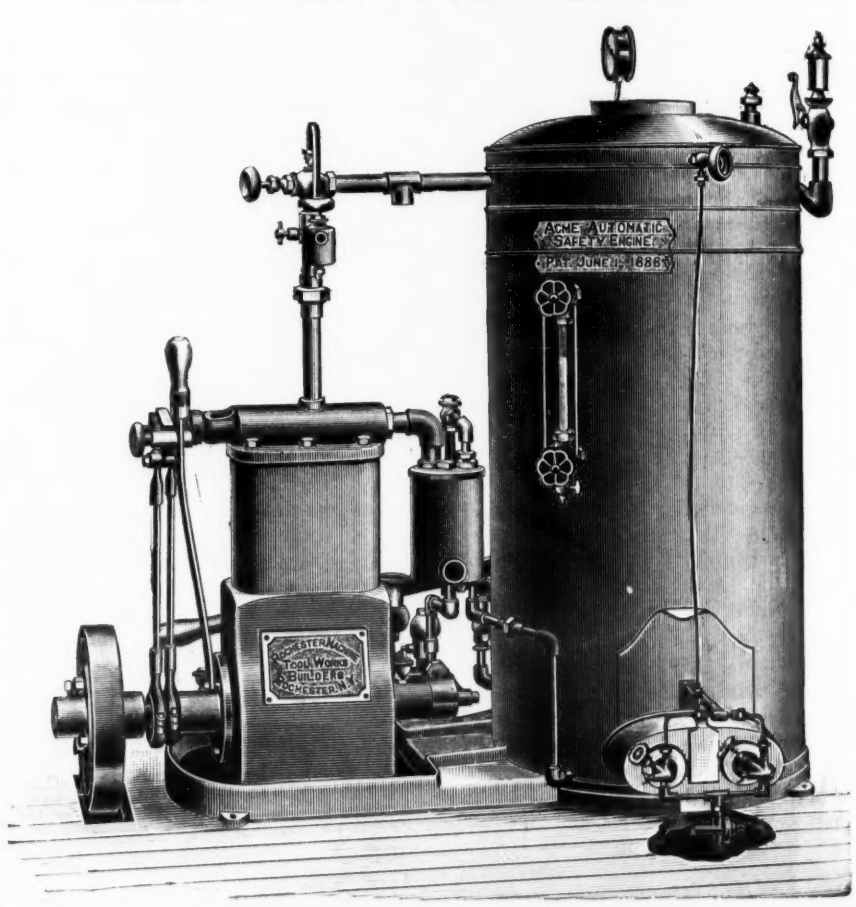
The Acme Yacht Engine.

On this page we give illustrations of a small marine boiler and engine, designed to meet the requirements of U. S. inspection laws, as well as to furnish the required power with the minimum of weight.

The boiler is shown separately with the jackets and some of the tubes removed, to show its construction. The fuel used is kerosene oil, the boiler and its appurtenances being especially designed for it. The center tube or water column is a drawn steel tube, which is drilled and threaded by special machinery to receive the radial tubes which are screwed into it. The outer ends of these tubes are each provided with a T of special form, which is machined so that a very thin copper gasket placed between them, and a bolt passed through from top to bottom, makes steam-tight joints. By this construction a free water-way is provided at each end of the tubes, and a free and rapid circulation secured.

The boiler was approved by the Board of Supervising Inspectors of Marine Boilers of the U. S., at their meeting in January last. Economy is secured by the ample heating surface, so arranged as to absorb the heat from the gases to the fullest possible extent, and by thorough double-jacketing with asbestos between the inner and outer jackets, which not only prevents the loss of heat, but makes the boat much more comfortable in warm weather. Two oil burners are used, their arrangement being shown in the general view, and the fire tube being in position in the other view.





THE ACME YACHT ENGINE.

The engine is double-cylinder single-acting, with cranks 180° from each other. The valve case forms the cylinder heads, and contains an oscillating valve worked by a link motion. It has ample port openings, and is balanced so that it is very easily handled, and can readily be reversed with the throttle wide open. The exhaust is through the center of the valve into a heater case, which contains a coil of pipe through which the feed water is forced by the pump, which is worked directly from the shaft of the engine.

The cranks are inside the casing, and run in a mixture of oil and water, thus insuring thorough lubrication, and, as the work is all done upon the downward strokes, there is no trouble with the connections, and no noise or jar at high speeds. The weight of both engine and boiler is kept as low as possible, in order to increase the stability of the boat.

They are built in sizes from one to four horse-power, by the Rochester Machine Tool Works, Rochester, N. Y.

It will be recalled that a short time since we drew attention to some of the peculiar operations of the Bell Telephone monopoly in the case of an interference in the U. S. Patent Office. The returns—the financial returns—for this and similar operations may be gathered from the recently published report of the annual meeting in Boston, where it was shown that the company "earned," during last year, a dividend of nearly 25 per cent. The exact figures are 24.45 per cent., though, so far as forming an estimate of the actual profits of the stockholders upon their capital invested is concerned, there is no need to be exact, for the stock has been so liberally and repeatedly watered, that the real dividend undoubtedly exceeds 100 per cent., as has been shown to be the case with the local company here in New York, whose dividends during three years—1885-'86-'87—ranged from 110 to 116 per cent.

These dividends are partly accounted for by the fact that, for instruments costing $3.42, they charged an annual rental of $14, and it is to be presumed that all the other charges for the service were based upon a similar proportion.

Some idea of the liberal scale upon which values are estimated as a basis for the issuance of stock and for declaring dividends, may be gathered from the fact that property which, according to the sworn testimony of the company's officers, had cost $129,550, was put in at a valuation of $3,895,300, or about thirty times its cost. So that a dividend of 25 per cent. upon the stock representing this particular part of the property would really be a dividend of about 750 per cent. upon the actual capital invested.

Secretary Hutton announces by circular that arrangements have been made for a removal of the headquarters of the American Society of Mechanical Engineers to No. 64 Madison avenue, New York; this will be the address of the society after April 20. Three large rooms on the ground floor have been secured. Until the first of October the rooms will be open from 9 in the morning until 5.30 in the afternoon. About October 1, of which further notice will be given, the rooms will be open evenings.

The *Railway Age* publishes figures going to show that the mileage of railroads projected the first three months of this year is greater than for the same time in any previous year, and that, notwithstanding opinions to the contrary, there is a good deal of road under construction. If the figures given are correct there will soon be an increased demand for locomotives and railroad tools.

A machine shop in a growing town has a very large lathe, and the superintendent was boasting of its many superior points, when little Bob cut him short with, "Oh, well, say it will turn anything from a handspring to a corner, and let it go at that."—*Harper's Young People.*

It is said if a hollow hemisphere is turned first with its concave, and then with its convex surface towards the wind, the pressure sustained will be respectively 1.94 and 0.77 times as much as on a plane surface of equal projection.

Two hundred and five acres of land have been purchased by the trustees of the Williamson free mechanical trades' schools. The land is situated in Delaware county, Pa.

A Russian engineer who was sent to Central Asia to investigate, reports oil wells there containing at least 9,000,000,000 pounds of pure oil.

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Milling Machines and Skill.

No one who has had sufficient experience with the milling machine in its various forms to acquire a reasonably clear idea of its capabilities, and who has an opportunity to see the machine in use in the various shops, can fail to see that in many of them it is very imperfectly understood, and that, as a consequence, comparatively poor results are obtained from its use—results, we mean, which are very poor compared with those which should be obtained and are obtained in every case where the legitimate functions of the machine are clearly recognized, and the conditions necessary to its successful operation secured.

The milling machine intelligently selected or constructed, with reference to the work it is expected to do, provided with well-designed and well-made special fixtures, where the nature of the work calls for them, and then skillfully handled, is a surprisingly efficient tool. But used as it is being used in many shops to-day, it is a delusion, a failure, and an injury alike to the users, to the builders, and to the good name of milling machines generally.

While it is true that there is scarcely a machine tool in use which will yield more satisfactory returns for a given outlay, when pains are taken to use it in the best possible manner, it is also true, we think, that there is no tool in common use, the efficiency of which is so much reduced by careless or ignorant handling and abuse. Considerable intelligence and skill, as well as constant attention, must be bestowed upon milling machines in order to secure anything like a satisfactory performance from them, either in the quality of the work done or in its quantity.

In some cases this skill and intelligence must be possessed and exercised by the man who actually handles the machine, in other cases by some one who, though he does not actually operate it, supervises its operation, and is responsible for the work done by it. But, in any case, the skill, the intelligence and the careful attention must be exercised, or the results will be anything but satisfactory.

We hear a great deal about the comparatively cheap labor required to do milling machine work, and it is evident that too many shop proprietors have concluded from this that about all that is necessary to do such work is to buy the machine, hire a boy to run it, have him "shown how" for an hour or so by one of the lathe hands, and then let the boy and the machine work out their own salvation.

No greater mistake could possibly be made, and it is in such a shop that a milling machine man finds the machine working often at less than half its capacity, with an apology for a cutter, ground by hand in every shape but the right one, two or three only of its superabundant teeth touching the work, and they, with a distinct thump and knock, indicating anything but a real cutting action, while the boy stands by and occasionally—when it occurs to him to do so—squirting a few drops of black lubricating oil onto the chips with which the spaces between the teeth are tightly jammed. The proprietors of such shops are not usually very enthusiastic regarding the use of milling machines, and it would be a wonder if they were.

Where a universal milling machine is used upon tool work, or for other purposes requiring a constant change from one job to another, it is a mistake to suppose that there is economy in the employment of a boy or cheap man to operate it. And many of those who think they are saving money in that way would be greatly surprised to see the work turned out from such machines by good mechanics who thoroughly understand them, and are capable of earning good wages upon them.

Experience has proved that it pays as well to put first-class mechanics upon such machines as upon any other machine tools.

Where milling machines are used for regular manufacturing operations, and the same cycle of movements is to be repeated for a large number of pieces, boys, or men who are not skilled mechanics, answer every purpose; but the skilled supervision must be there, and it must be seen to that the machine is as well taken care of, the cutters as well made and ground, and, in fact, everything as well done as though a good mechanic actually operated the machine. In fact, in the shops in which the best results are obtained from the use of milling machines in regular manufacturing operations, all changes of the machines from one job to another, all adjustments, and the grinding and replacing of cutters are done by, or at least under the direct supervision of a skilled mechanic, responsible for the work of the machines, and who thoroughly understands and appreciates them. In this way only can the full benefits of the machine be realized.

It is far too common to go into tool-rooms and find a splendid universal milling machine standing idle, while perhaps two or three men are doing at the shaper, planer or vise, jobs which could be done by an expert milling machine hand in one-fourth down to one-tenth of the time, and a great deal better. One fault, which is far more common than would readily be believed in some quarters, is a failure to recognize the fact that a milling machine necessarily calls for some sort of a machine for grinding cutters, and that a machine upon which cutters are used, that are ground by holding the edges one after the other against an emery wheel by hand, is at a decided disadvantage, and will do no work which either in quality or cost will make a favorable showing when compared with that which is done by properly ground cutters.

It should be much more generally recognized that in milling machine practice, as in other things, there is a right way and a wrong way, and that skilled, intelligent labor pays best. When these facts are more generally recognized, it will be better for both the builders and for the users of the machines.

Mechanical Advice.

The position of the mechanical engineer as a professional man is not, on the whole, a very satisfactory one. A man will employ a lawyer and pay him well for an opinion, and quite properly, too. The lawyer has spent a good deal of time in making himself competent to give advice, and, as a rule, gets none too much for it. But the same man that will pay for legal advice, will contrive to get mechanical advice for nothing, or go without it; quite generally the latter. This latter fact accounts for the ease with which many good business men in other respects, are induced to put their money into worthless mechanical schemes that almost any mechanical engineer to whom they might have applied for advice could have shown them the folly of.

It seems strange in this respect that so little is learned by experience, as indeed it is strange that men should put large sums of money into anything, the mere rudiments of which they are unacquainted with, without getting disinterested advice from those having the necessary qualifications to give it.

One's memory need not be very retentive to call to mind, at any time, a dozen schemes by which the unwary have been entrapped, and which every mechanical engineer of ordinary ability knew to be failures from the start.

A little loose talk about the small percentage of heat utilized in the steam engine has led many a man to invest handsomely in some boiler or engine scheme that was to save all that is lost, when a few minutes' talk with a competent engineer would have demonstrated the impossibility of doing anything of the kind.

A physician knows the impossibility of certain things in the practice of medicine, that, to the uninitiated, look plausible enough, so the engineer knows the impossibility of things in his line of work and investigation, that appear reasonable to the man whose studies have been in another direction.

An instance of this once came to our notice. At a meeting of the medical fraternity a well-known physician was to deliver a lecture. He had expended much time in his preparation, and he had, by way of illustration, woven in the action of steam and the steam engine all through his lecture. Upon this part of his subject he had read just enough to acquire that modicum of learning said to be dangerous. Before the time for his effort came, he, just to have his views confirmed, applied to an engineer to look over his illustrations so far as steam was concerned. They were so entirely wrong, and he was so willing to admit his lack of knowledge, that it was not a very difficult matter to set him right, but doing so left rather serious gaps in the lecture, which he presumably repaired to his satisfaction. There was palpable evidence of satisfaction on his part, at being, almost by accident, saved from a chapter of blunders, but—this was ten years ago—he has not offered to pay the engineer for his services yet.

There is but little value set upon mechanical advice, but, as the world grows older, it may grow wiser in this respect.

Philo Remington.

Philo Remington, who died recently at Silver Springs, Fla., was the oldest of the three Remington Brothers, who established the large shops and armory at Ilion, N. Y., in connection with which they secured a world-wide reputation. The Ilion Armory filled important orders for the United States government during the civil war, and so satisfactorily that the Remingtons were thanked by special resolution of Congress. The firm also became the agents of the French government during the Franco-Prussian war, and received the thanks of that government at its conclusion. The deceased was known as one who aided many a poor inventor, and otherwise made the world better for his having lived in it. He was born in 1816.

Andrew Carnegie, the great iron manufacturer of Pennsylvania, has taken up arms against the well-to-do Pennsylvania Railroad Co. In a speech before the legislature at Harrisburg, he claimed that the Pennsylvania Company discriminated against the industries of Pennsylvania, in the way of freight charges, was driving manufactures out of the State, and that the value of farming lands was being depreciated.

Literary Notes.

THE LUMBERMAN'S HAND BOOK OF INSPECTION AND GRADING. New edition of 1889. By W. B. Judson. Illustrated.

This book contains information in regard to the inspection of lumber in the various States, that must be of great value to lumbermen and those making use of lumber. It also contains the lien laws of different States, and a good deal of miscellaneous information, tables, etc. It is neatly printed and bound, and well indexed. It is published by the *Northwestern Lumberman*, Chicago, and sent by mail for $1.25.

The Hartford Steam Boiler Inspection and Insurance Company has issued volume IX. of *The Locomotive*. It is fully up to the standard of those that have preceded it, and can be commended to every reading engineer. The price is one dollar.

Questions and Answers

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(170) A. L. M., Wilmington, Del., sends us a rule for proportioning cone pulleys, and asks us to explain the rule, as he does not understand it. *A.*—The rule will not give the correct proportions; indeed, we do not see how it can be used. We believe the methods for proportioning cone pulleys given in our issues of Oct. 15, 22, Nov. 26, 1881, and Dec. 1, 1888, are about the simplest that can be used.

(171) S. T. B., Rutland, Vt., writes: Will you please inform me if there is a cheap machine for testing the transverse strength of small bars of cast-iron on a common scale? I think Mr. R. E. Masters has described such a machine, and published it in the AMERICAN MACHINIST. If so, please give date of the paper containing it. *A.*—March 27, 1886.

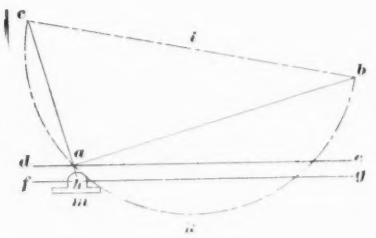
(172) F. S. C., Cambridge, Mass., asks: Is there any way of gearing an engine so as to obtain more power from it; the speed of the engine and shafting is not to be changed? *A.*—The work of the engine cannot be increased unless the speed or pressure on the piston, or both, are increased. Whether this can be done will depend upon the proportions of the engine, and also on the steaming capability of the boiler.

(173) U. S. V., Bushnell, Ills., writes: Please find enclosed drawings of a slide valve and its seat for an old engine which I have lately rebuilt. I think the valve can be changed so as to enable the engine to do more work. I would like to have your advice as to what would be best to change, and how much. Cylinders 9x22 inches. *A.*—We notice that there is an inside lap of 7-16 inch. Reduce the inside lap to 1-16 inch; this change will give better results.

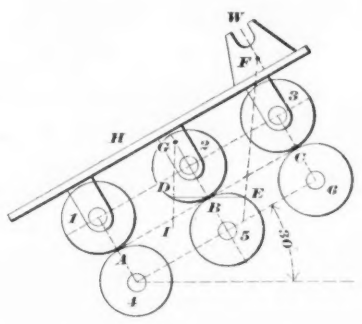
(174) A. K. L., Easton, Pa., writes: 1. We have two horizontal boilers as per sketch; 30 feet long, 38 inches diameter, with one 12-inch flue. The boilers are walled-in brick; good sharp draft. What is about their horse-power? *A.*—At 12 square feet of heating surface per horse-power, each boiler will be rated at 18.75 H. P. At 15 square feet of heating surface each boiler will be rated at 15 H. P.; we prefer the latter figure. 2. What horse-power will a 16-inch double belt transmit when the driving pulley is 16 feet diameter, running at 48 revolutions per minute? The driven pulley is 5 feet diameter, everything in good condition. *A.*—100 horse-power.

(175) E. L. M., Philadelphia, Pa., writes: Please inform me of a method by which I can paste pebble paper on cardboard smoothly. I have tried it several ways, but the paper always wrinkles. *A.*—Apply the paste to the paper, not to the cardboard. Commence by pasting down one edge of the paper, carefully holding up the opposite end, and then gradually bring the paper and cardboard into contact by smoothing down the former with a flat brush or cloth; in doing so, care must be taken to work out all the air from under the paper. Should any air remain under it, a few holes must be pricked through the paper, to allow the air to escape. Considerable skill is necessary for securing success, and this you can only obtain by practice and experience.

(176) F. P., Chicago, Ill., sends us the following problem, for which he asks a geometrical solution. In the accompanying sketch the points *c* and *b* are fixed ones, and *d e*, *f g* are two given lines parallel to each other; *m* is a movable bracket with a pin whose center is marked *h*. It is required to find on the line *f g* a position for the center *h*, so that a line joining the points *h* and *c* will be perpendicular to a line drawn through the points *b* and *a*; the lines *c h* and *b a* are to meet each other on the line *d e*. *A.*—In the solution of this problem we throw the point *h* out of consideration, and thus reduce the problem to a very simple one, namely, to draw through points *b* and *c* lines which shall be perpendicular to each other, and meet on the line *d e*. To do so, join the points *c* and *b* by a straight line; find the center *i* of the line *c b*; from this point, and with a radius *c i*, describe the semi-circle *c k b*, cutting the line *d e* in the point *a*. Join the points *c* and *a*, also *b* and *a*, by straight lines; the lines *c a* and *b a* will be perpendicular to each other, because they are chords meeting each other and passing through the extremities of the diameter *c b*; hence, the first condition of the problem is fulfilled. To fulfill the second condition, we only need to prolong *c a*, cutting *f g* in the point *h*, which is the point sought.



(177) J. M., Woonsocket, R. I., writes: 1. Required a point of suspension for a weight *W* that shall give equal pressures upon three pairs of rolls ¾ diameter, when these rolls are equal distances apart? *A.*—Find the center of gravity of the carriage *H*, and the rolls 1, 2, 3, combined. Assume now that the center of gravity is at *G*, and for the sake of simplicity also assume that the upper rolls 1 and 3 are not in contact with lower rolls 4 and 6. Under these conditions the total weight of the upper rolls 1, 2, 3, and the frame, will be supported by the point of contact *B*. Through the center of gravity *G* draw a vertical line *G I*, and through the point of contact *B* draw the horizontal line *B D*. The line *G I* will be the direction in which the force of gravity acts, *D B* will be the arm of this force, and the effect of this force to produce rotation will be measured by its moment; that is, the product obtained by multiplying the total weight of the rolls and carriage by the length of the line *D B*. If, for instance, the weight is ten pounds, and the line *D B* ¾ of an inch, the moment will be $10 \times \frac{3}{4} = 7\frac{1}{2}$ inch pounds. Now, in order to obtain an equilibrium around the point *B*, we must place the weight *W* in such a position as to obtain a moment which is equal to the moment of the force *G I*. The weight *W* and that of its bearings *F* we suppose has been established, and must not be changed. Hence, divide the moment of the force *G I* by the



weight *W*, plus that of its bearings *F*; the quotient will be the arm *B E* of the force due to *W* and *F*. If, for instance, the combined weight of *W* and *F* is 5 pounds, and the moment of the force *G I* equal to $7\frac{1}{2}$ inch pounds as previously found, then the arm *B E* will be equal to $\frac{7\frac{1}{2}}{5} = 1\frac{1}{2}$ inch. The arm *B E* must of course be drawn horizontally, so as to be perpendicular to a vertical line. Through *E* draw the vertical line *E F*, and on this line place the center of gravity of *W* and *F* combined. This will produce equilibrium, and when the rollers 1, 4, also 3, 6, are brought into contact without disturbing the horizontal line *D E*, these rollers will bear an equal amount of weight. To make the three pairs of rolls bear equal weights is simply a matter of adjusting the rolls to the line *A C*. 2. Suppose the rolls 1 and 4 are permanently fixed, but the distance between the pairs of rolls varied so as to make *A B* always equal to *B C*; it is now required to find the position of the weight *W*, so as to maintain an equal pressure on all the three rolls in whatever position they may be placed. *A.*—Impossible; because this would change the ratio between the arms *D B* and *B E*, and since the weights remain the same, the moments of the forces acting around *B* will also be changed. On the other hand, if the rolls 2 and 5 remained fixed, then the distances *A B* and *C D*, so long as they remain equal to each other, can be changed without disturbing the weights placed upon them.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue

Gear wheels and g-cutting. Grant, see adv., p. 16.
Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.
20″ Upright Drills. J. E. Snyder, Worcester, Mass.
23″ Upright Drills. J. E. Snyder, Worcester, Mass.
25″ Upright Drills. J. E. Snyder, Worcester, Mass.
28″ Upright Drills. J. E. Snyder, Worcester, Mass.
Special tool work. R. M. Clough, Meriden, Conn.
Shafting Straighteners. J. H. Wells, Tampa, Fla.
Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.
The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.
Berryman Feed-Water Heater and Purifier. Benj. F. Kelley, 91 Liberty street, New York.
Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.
Builders of Automatic Engines and Machinery. F. C. & A. E. Rowland, New Haven, Conn.
R. Dudgeon, 24 Columbia st., New York. Improved Hydraulic Jacks and Roller Tube Expanders.
Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.
Machine Screw Taps of all sizes and threads, manufactured by S. W. Card & Co., Mansfield, Mass.
"Swift" Sight Feed Lubricator; no glass tubes; simple, reliable. Swift Lub'r Co., Elmira, N. Y.
Power measured with guaranteed Dynamometers, Franklin Van Winkle, 91 Liberty st., New York.
Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.
"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.
Fire Brick and Clay Retorts for all kinds of heating and melting furnaces. Borgner & O'Brien, Phila.
Ice and Refrigerating Machines, 131 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.
"How to Keep Boilers Clean." A 96-page book mailed free by Jas. E. Hotchkiss, 120 Liberty st., N. Y.
Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y.
Best silk wiping towels for machinery in the market. S. A. Smith, 23 S. Canal st., Chicago, Ill.
For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.
Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illustrated. Frasse & Co., 92 Park Row, New York.
Split Pulleys at low prices and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.
See Illustration of Portable Key-Seating Machine in April 4 issue. For further particulars address T. C. Dill Mach. Co., 726 Girard av., Philadelphia, Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See April 4, p. 10. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.
Fine tools and supplies for machinists and other metalworkers. Get our prices before purchasing elsewhere. Montgomery & Co., 105 Fulton st., N. Y. City.
The Holly Manufacturing Company, of Lockport, N. Y., will send, on application, their pamphlet illustrating pumping machinery and reports of duty trials.
W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches, working drawings for the transmission of power by steam, water, air and electricity.
Contract work of all kinds executed promptly and on reasonable terms. Parties wishing grey iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N. Y.
Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages illustrated, 12mo., cloth, $2.00. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N. Y.
The International Boiler Co., Limited (Allan Stirling, M. E., president,) manufacture the safest, most economical, compact and durable water tube boilers. All wrought metal. Large mud drum. Perfect circulation. By unscrewing only three bolts, access is gained to every part of the boiler. Dry steam and great economy of fuel guaranteed. Office, 74 Cortlandt street, New York.
"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor place, New York.
"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.
"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including March 14, 1889 issue, 72 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.
"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 87 articles have thus far appeared up to and including the March 21, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

T. B. Pratt will build a saw and planing mill at Bastrop, La.

Thomas Huffman will start a furniture factory at Bessemer, Ala.

Stringfellen & Whetstone will build a planing mill at Anniston, Ala.

Carn & Co. will build a sash, door and blind factory at Roanoke, Va.

Subscriptions are being solicited for a $50,000 iron foundry at Houston, Texas.

Peter Campbell expects to start a machine shop and foundry at Anniston, Ala.

The Norfolk and Western Railroad Co. will build repair shops at Roanoke, Va.

The nut and bolt works at Youngstown, Ohio, were recently destroyed by fire.

The Anderson (S. C.) Cotton Mill Co. has let the contract for building a brick mill.

The lumber mills of H. Lienhard, at Handsboro, La., were recently destroyed by fire.

E. E. Roberts is building an addition 50x100 feet to his boiler works, at Red Bank, N. J.

Thomas Boggs, of Philadelphia, Pa., will largely increase his plant of carpet machinery.

The Pittsfield (Mass.) Manufacturing Co. are making extensive additions to their woolen mills.

A company is being formed at Texarkana, Texas, to convert the Star Planing Mill into a furniture factory.

The Billings & Spencer Co., Hartford, Conn., have forty drop hammers in operation, having recently added two.

Ritchers' window shade factory, at Tenafly, N. J., containing a large amount of machinery, was totally destroyed by fire recently.

The Gibson-Hilliard Manufacturing Co. are building a factory at Florence, Ala., in which to manufacture hubs, spokes, handles, etc.

The mill operatives in Manchester, N. H., have voted to ask for a half-holiday on Saturdays, and have presented a request to that effect to mill owners.

West Knoxville, a suburb of Knoxville, Tenn., voted on issuing $100,000 in bonds for street improvements. The question was carried unanimously.

A company is being organized at Tuscaloosa, Ala., for the establishment of a shoe factory, with a cash capital of $100,000. Negotiations are now pending for the site.

A. T. Koopman, Chicago, Ill., has issued a catalogue of mechanics' small tools and supplies, either made by him or sold as manufacturers' agent. The list is quite complete.

Busiel Brothers, Laconia, N. H., having acquired the sole right to make and sell, in the United States and Canada, a new knitting machine, will increase their machine shop facilities.

It is said that the Louisville (Ky.) Realty and Improvement Co., recently organized, has bought 1,200 acres of land, and have secured the building of steel works and bridge works.

Russell & Co., Massillon, Ohio, recently made a shipment of 26 car loads of machinery to Portland, Ore. Amongst the machinery shipped were 32 steam engines. The 26 cars were run as a special train.

The Baton Rouge (La.) Gas, Electric Light and Power Company has been formed by the union of the Baton Rouge Electric Light and Power Company, and the Baton Rouge Gas Company. Capital, $60,000.

The Williamstown (Mass.) Gas Company, which has been chartered, has begun work on its plant. The Williamstown Electric Light Company has also applied for permission to put in a gas plant, but will put in electric light first.

A stock company has been formed at Lowell, Mass., to build an immense cotton plant, the first mill to have a capacity of 40,000 spindles, and to employ 700 hands. It is believed that within ten years four of these mills will be erected.

We have received from C. W. Hunt Company, Staten Island, N. Y., and 45 Broadway, New York, a large sheet, containing illustrations of machinery for unloading vessels and storing cargoes. They make a very complete line of machinery and parts for this purpose.

The Farmers' Co-operative Manufacturing Co., of Griffin, Ga., has been chartered by W. V. Maddox and others. They have a capital stock of $25,000, with privileges of increasing it. They will operate a cotton ginnery, a guano factory, and also run a cotton and oil mill and grist mill.

Ryan & McDonald, Waterloo, N. Y., build hoisting machinery, derricks, dump cars and railroad contractors' supplies generally. For some time past they have been overcrowded, and have finally concluded to enlarge their plant, and to add a good deal of new machinery.

The Chelsea (Mass.) Wire Fabric Rubber Co. has bought land (40,000 feet) in Chelsea, and will erect a factory for the manufacture of wire fabric, rubber hose and belting. The building will be of brick, 127x42 feet, and two stories in height. The company has a capital of $100,000.

Hine & Robertson, 45 Cortlandt street, New York, have prepared a catalogue, illustrating and describing their specialties in engineers' and machinists' supplies. They have recently been appointed sole sales agents for the Champion Flue Scraper, which, we are informed, is meeting with great success.

There is water-works agitation at Tallahassee, Fla.; Waycross, Ga.; Harrodsburg, Ky.; Mount Sterling, Ky.; Winchester, Ky.; Shelbyville, Tenn.; Dallas, Tex.; Grant, Neb.; Morristown, Tenn.; Provincetown, Mass.; Lorain, Ohio; Grafton, Mass.; Riverside, Mass.; Fairhaven, Mass.; Sheffield, Ala.

The Pioneer mill and property, known as the Carroll Mill, at Mill River, in New Marlboro, Mass., has been rented by a paper manufacturer of New York city for a year, with the privilege of renewal for five years. He will make fine writing paper. The mill will be repaired and started in a few weeks.

The Cushman Chuck Co., Hartford, Conn., are sending to their customers who are large dealers, stands, each containing fourteen chucks of different sizes, from 3 inch to 12-inch capacity, the chucks representing the most prominent ones in their line of manufacture. The chucks are so arranged that each of them can be operated with ease, and the stand makes a very effective and convenient way of showing them.

By an almost unanimous and a very enthusiastic vote, the Farmers' Alliance of Georgia, representing 80,000 farmers, in session at Atlanta, resolved recently that they would use cotton bagging for the baling of their cotton, and would not use jute under any circumstances. It is said that three-fourths of the delegates came from their county alliances instructed to vote for cotton bagging under any and all circumstances. While this obstructed impartial consideration, it gives enthusiasm and earnestness to the movement.

The Ashleyo Company (Limited) of Louisiana, has decided to inaugurate a decided improvement in Madison parish. This company owns about 70,000 acres of fine lands in the parish, and this year has 15,000 acres in cotton, and about 5,000 in corn. The company will build a narrow-gauge railroad forming a belt line, which will traverse all of its plantations, and penetrate its lands, which are now only partially improved, thus materially increasing their value. The road will start at Ashley, formerly known as Milliken's Bend, on the Mississippi River, and will run back through the Willow Bayou section to Tallulah, on the line of the Vicksburg, Shreveport and Pacific road, thence back to the starting point. The line will be about twenty-five miles long. It is also stated that Mr. John P. Richardson and others will build a narrow-gauge line connecting their various landed interests in Tensas county, leaving the Vicksburg, Shreveport and Pacific at Dallas station, and joining it at Altoona, making a distance of about thirty-five miles.—*Mobile Register.*

Machinists' Supplies and Iron.

New York, April 13, 1889.

Iron—American Pig.—Offerings seem to be in excess of the demand, and the indications are that considerable concessions are being made from the quoted prices. We quote No. 1 X Foundry, $17 to $18; No. 2 X Foundry, $16 to $17; and Grey Forge, $15 to $15.50.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—See bottom of third column, page 11.

A 1 draftsman. Who wants him? Address A., care American Machinist.

Wanted — Situation by mechanical draftsman. Address Box 88, American Machinist.

Wanted—In a Western city, a first-class pattern shop foreman. Address F., American Machinist.

Wanted—Good man on steel rules; must be experienced and thoroughly competent. Address Box 84, American Machinist.

A young Swedish mech. eng., good draftsman and calculator, is open for engagement. Steam eng'g preferred. First-class refs. Address "185," Am. Mach.

Wanted—Position by young man to make working drawings from sketch, or as assistant designer. 8 years' experience in shop and drawing-room. Address Practical, American Machinist.

Foreman boiler maker wanted, accustomed to stationary, marine and locomotive work. Good place for an energetic, able man. Address, giving age, experience, etc., P. O. Box 337, Richmond, Va.

Wanted—A mechanical draftsman who is familiar with stationary engine drawing; need not be expert in designing. The work required is chiefly copying and tracing. Address Box 87, American Machinist.

Foreman boiler maker wants to change; 21 years' experience; good at handling men and tools; best reference. No one answer except meaning business. Address W., American Machinist.

Wanted—A first-class moulder, competent to superintend a foundry. Must have $5,000; a good salary will be paid to a first-class man. Address Box 78, American Machinist.

Wanted—Superintendent to take charge of a wood-working machinery manufactory; must be versed in designing, pattern making, and understand the handling of men. Address Indiana Machine Works, Fort Wayne, Ind.

Machinist, good vise hand and mechanical draftsman, graduated at a technical school abroad, wants position. On steam engines and general machinery preferred. Is able to design if necessary. Address A. 32, American Machinist.

Wanted - Situation as foreman or supt. of boiler shop by man of experience on marine portable and stationary boilers; can estimate correctly and make own drawings if necessary. 34 years of age. First-class references. Boiler Maker, Am. Machinist.

Wanted—For a good permanent position, a good man thoroughly experienced in the different branches of fine machine work and tool making; one having knowledge of drafting preferred. Address, stating age, &c., F. A. Hunter, 129 4th St., Detroit, Mich.

Wanted—A foundry foreman thoroughly conversant with the business, with $1500.00 to invest in an established manufacturing business located in the best city in Ohio, population 30,000. A grand opening to the right party. Address for particulars, stating age, habits, experience, etc., C. F. S., Am. Mach.

An experienced mechanic and salesman would like to represent, at a branch house, a firm manufacturing engines, boilers, pumps, etc., or a tool works. Is familiar with the leading engines and tools in the market. Can furnish A1 references as to ability. Box 89, American Machinist.

Wanted—A department foreman to take charge of about twenty-five machinists. Must be experienced in the use of milling machines, turret lathes and special appliances for the manufacture of steam engine parts in duplicate. To the right man permanent work and good pay will be given. Address Edw. P. Allis & Co., Milwaukee, Wis.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Cyclone Steam Flue Cleaner is king; and has no rival. Crescent Mfg. Co., Cleveland, Ohio.

Crescent grease cup for shafting beats them all. Sample free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe. Catalogue for stamp. E. O. Chase, Newark, N. J.

August C. Christensen, 24 State st., N. Y., Consulting Engineer. Designs of all kinds of Machinery.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

An original and sure receipt for tempering and making Fine Drills. Two-cent stamp for terms. I. H. Bartholomew, Northford, Conn.

Machine shop and foundry for sale. A splendid opening. One thousand dollar job to start on. Address 615, American Machinist.

For sale, cheap, 32-inch Prentice Bros. Back-Geared Power Feed Drill Press, new. Price, $250. Address Standard M'f'g Co., Moore's Hill, Ind.

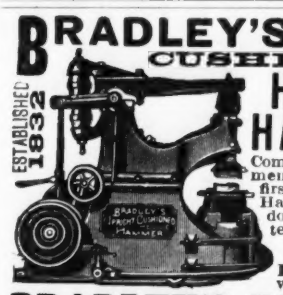
Wanted—To buy second-hand lathes, planers and shapers of all sizes; must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

How to remove and prevent scale in steam boilers at a cost of ten cents a week. Send postal for circular to Pittsburgh Boiler Scale Resolvent Co., Pittsburgh, Pa.

Boilers—The proprietors of a large engine works in Alabama desire to connect a large boiler works with their plant, and are desirous of finding a suitable party with necessary machinery and capital to operate such a plant. Box 80, Am. Machinist.

Parties wishing to exchange their old gear cutters for full automatic machines, address, giving description, "Trade," American Machinist.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Thos. Ordish, 1723 S. 7th st., Phila., Pa.



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Established 1832

Combines the best elements essential in a first-class **Hammer.** Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the world.

BRADLEY'S HEATING FORGES.

Established 1832

With a manufacturing experience of over half a century, we recommend these machines to be the best, simplest, most durable and combining all the essential elements. **For hard coal or coke.** Indispensable in all shops to keep Bradley's Cushioned Hammers and men fully employed and reduces cost of production.

Pat. Aug. 30, 1867.

BRADLEY & CO. SYRACUSE, N. Y.

98 Sudbury St., Boston, Mass.
63 Murray St., New York.

PATENT BUREAU United States and foreign letters patent obtained for inventions at reasonable rates. Claims carefully considered. For further information apply to

L. A. McCARTHY, Manager. J. B. SABINE, Attorney-at Law.
181 BROADWAY, N. Y.

"Star" Foot Lathe Swings 9x25 in.

LATHE

Screw Cutting Automatic Cross Feed, etc.

Scroll Saws, Circular Saws, Lathes Mortisers.

Catalogue Free of all our Machinery.

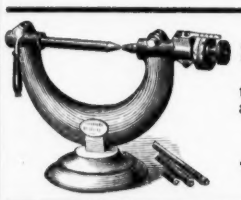
Seneca Falls Mfg. Co. 687 Water St., Seneca Falls, N.Y.

MACHINERY For Reducing and Pointing Wire.

ESPECIALLY ADAPTED TO POINTING WIRE RODS AND WIRE FOR DRAWING.

For Machines or Information, address the Manufacturer,

S. W. GOODYEAR, Waterbury, Ct.



SWEET'S Measuring Machine,

The only micrometer that will not lose its accuracy by wear.

Satisfaction Guaranteed.

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Syracuse, N. Y.

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ENGRAVER ON WOOD
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A Great Repository of Practical and Scientific Information.

One of the Fullest, Freshest and Most Valuable Handbooks of the Age, Indispensable to Every Practical Man.

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The Techno-Chemical Receipt Book:

Containing Several Thousand Receipts, covering the Latest, most Important, and most Useful Discoveries in Chemical Technology, and their Practical Application in the Arts and the Industries. Edited chiefly from the German of Drs. Winckler, Elsner, Heintze, Mierzinski, Jacobsen, Koller, and Heinzerling, with additions by William T. Brannt, Graduate of the Royal Agricultural College of Eldena, Prussia, and William H. Wahl, Ph. D. (Heid.), Secretary of the Franklin Institute, Philadelphia, author of "Galvanoplastic Manipulations." Illustrated by 78 engravings, one volume, over 500 pages, 12mo, elegantly bound in scarlet cloth, gilt, closely printed, containing an immense amount and a great variety of matter.

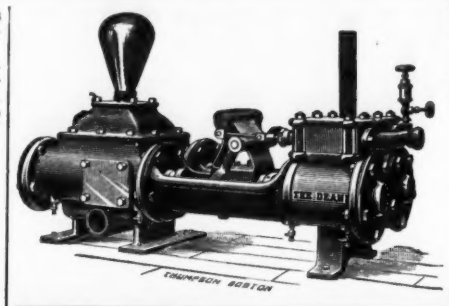
Price $2.00, free of postage to any address in the world.

☞ *A circular of 32 pages, showing the full Table of Contents of this important Book, sent by mail, free of postage, to any one in any part of the World who will furnish his address.*

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers & Importers,
810 Walnut St., Philadelphia, Pa., U. S. A.

93 Liberty St., NEW YORK. | 113 Federal St., BOSTON.

IMPROVED PUMPING MACHINERY | For Every Class of Work | Send for New Illustrated CATALOGUE.



THE DEANE STEAM PUMP CO.,
HOLYOKE, MASS.,
New York, Boston, Chicago, Philadelphia, St. Louis,
Manufacturers of
STEAM and POWER
PUMPS
FOR ALL PURPOSES.
SEND FOR CATALOGUE.

FOR SALE, One each 26" and 36" second-hand Stevens Pulley Machines. Also one second-hand Buckeye Automatic Engine, Cylinder 6"x10".

These machines are in first-class order, and will be sold cheap if disposed of soon.

THE HENDEY MACHINE CO.,
TORRINGTON, CONN.

TOOL AND DIE STEEL

Of the finest and most uniform quality. Spring and Machinery Steel. Drill Rods and Fine Wire. Sheet Steel. Self-Hardened Steel. Coiled Springs and Steel Forgings.

MILLER, METCALF & PARKIN,
CHICAGO, ILLS. PITTSBURGH, PA. NEW YORK, N. Y.

Sebastian, May & Co.'s Improved Screw Cutting FOOT AND POWER LATHES

Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.

167 West Second Street, CINCINNATI, O.

OUR SPECIALTIES, 8, 12, 14 and 18 Inch Lathes.

STEPHENS' PATENT VISES.

QUICK-ADJUSTING CAM AND TOGGLE JOINT.

Stationary or Patent Swivel Bases.

INCOMPARABLE FOR STRENGTH, DURABILITY, FIRM HOLD AND QUICK WORK.

Has improved Taper, Pipe and other attachments. Made in 2, 2¾, 3½, 4½, 5½, and 6½ inch width of jaw.

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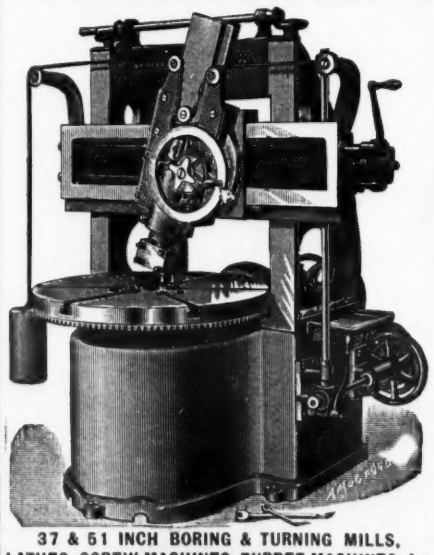

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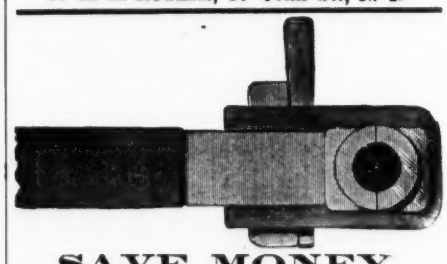

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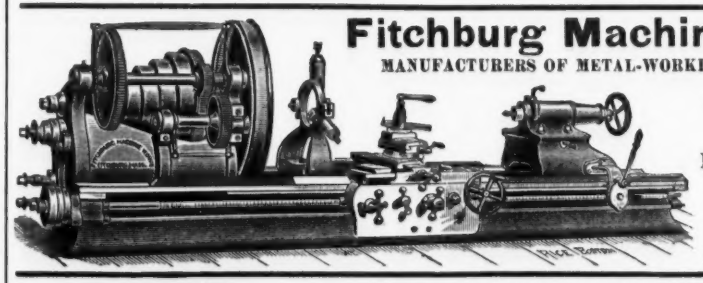

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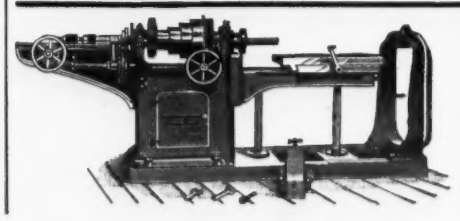

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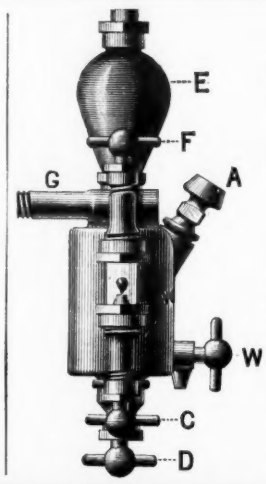

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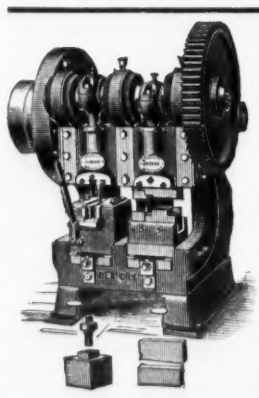

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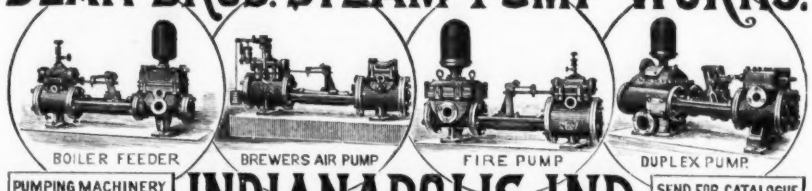

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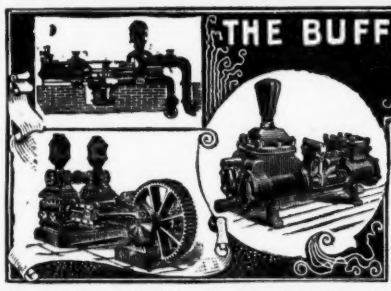

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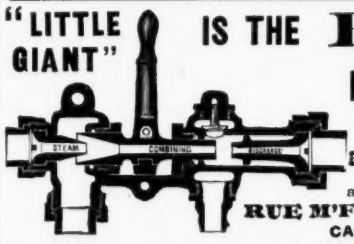

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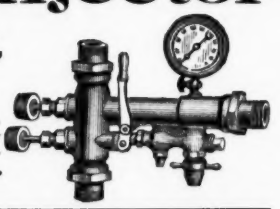

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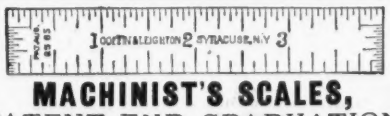

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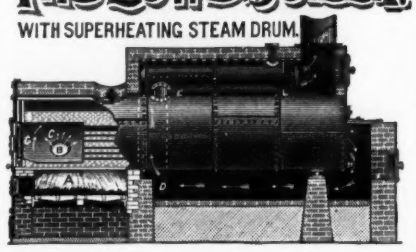

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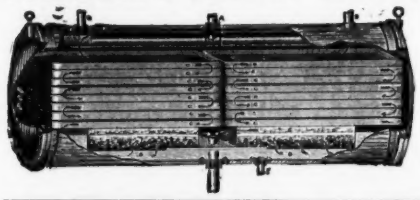

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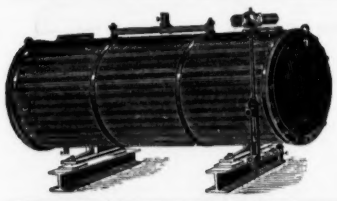

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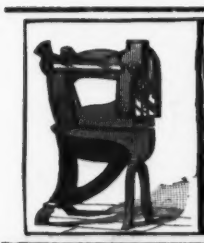

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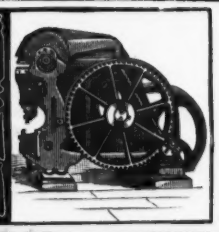

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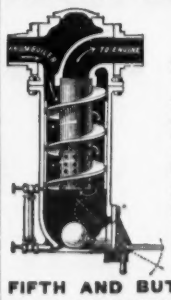

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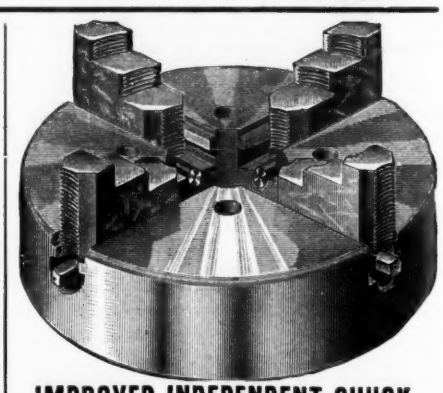

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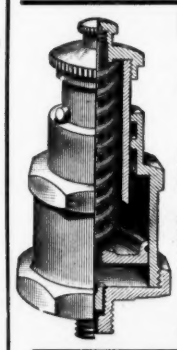

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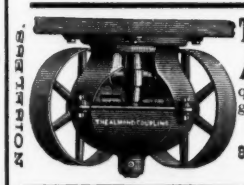

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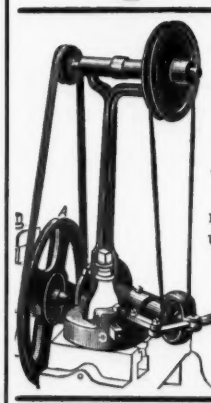

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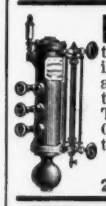

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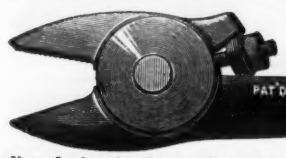

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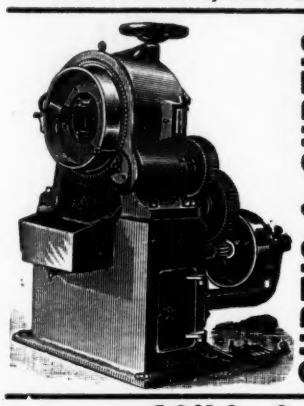

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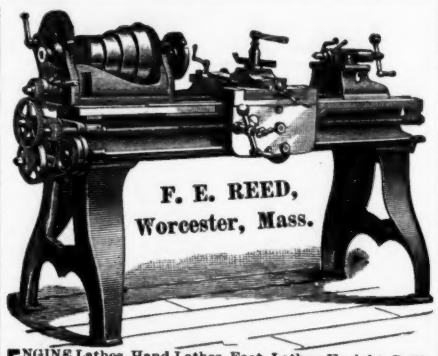

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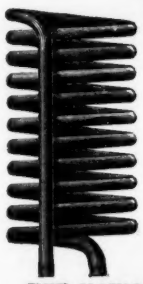

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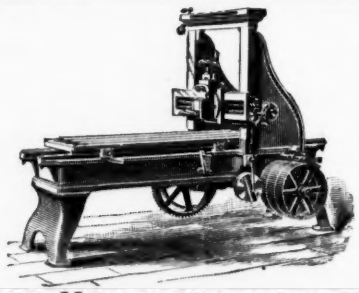

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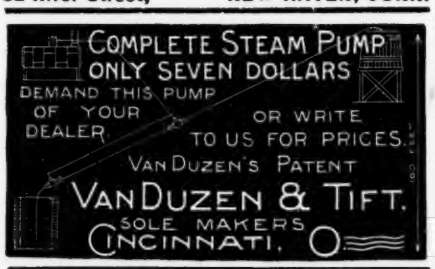

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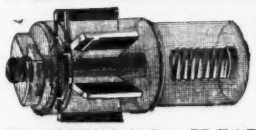

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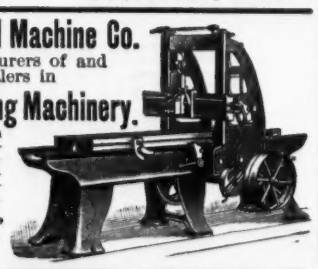

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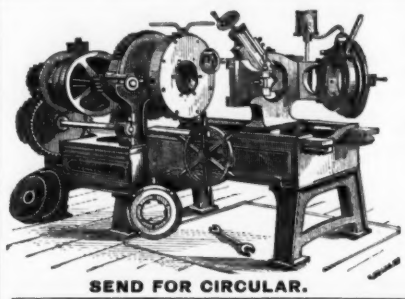

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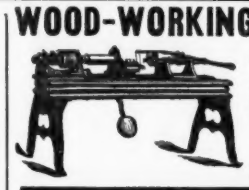

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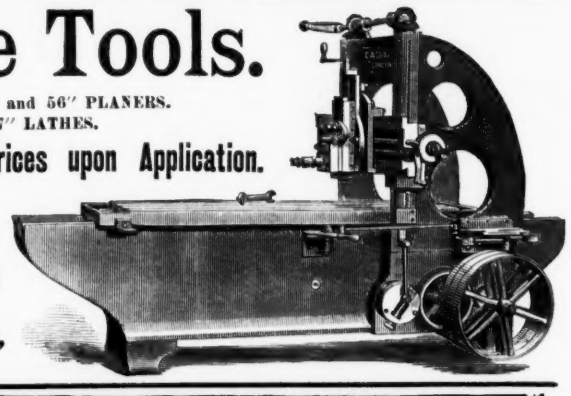

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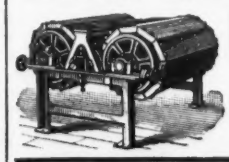

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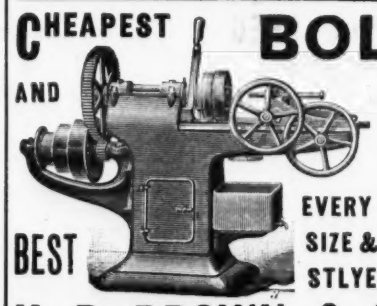

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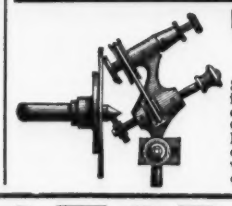

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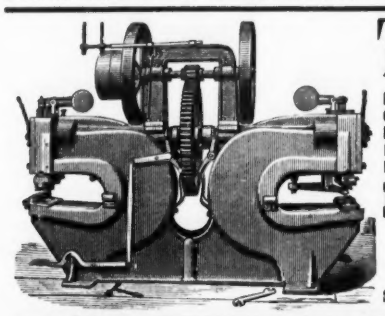

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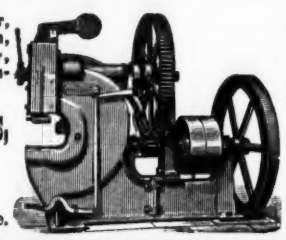

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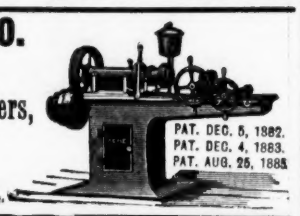

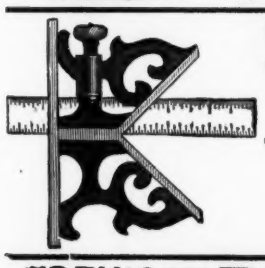

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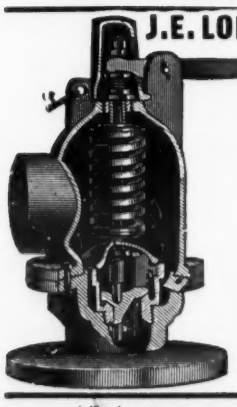

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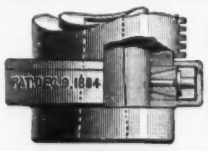

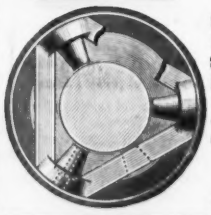

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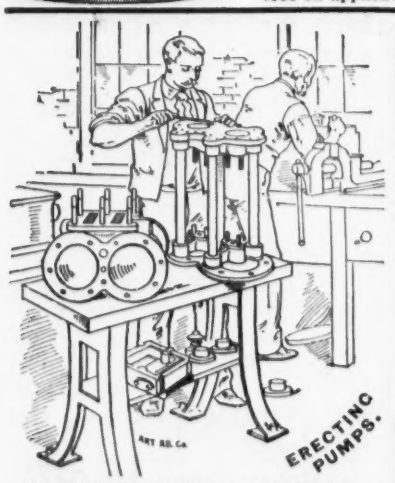

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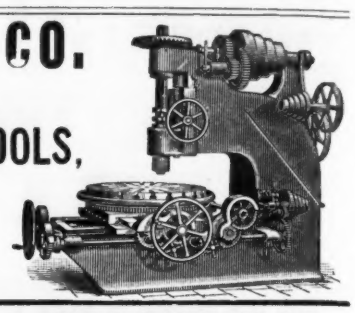

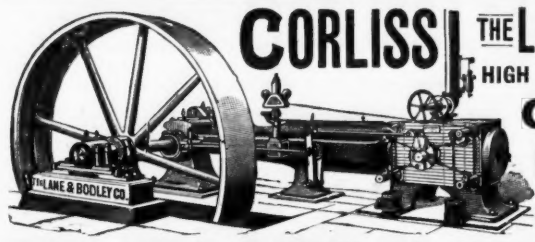

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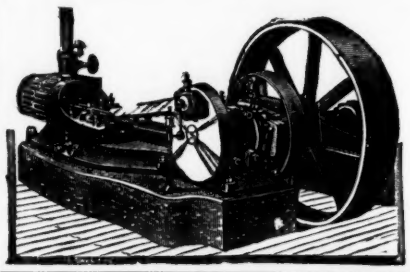

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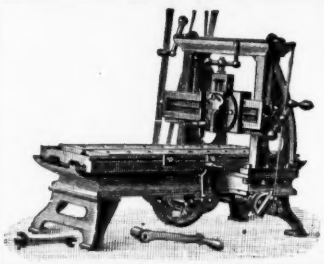

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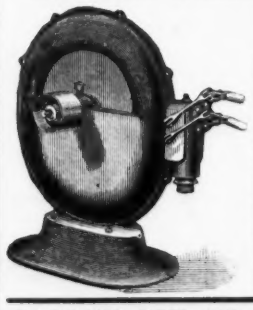

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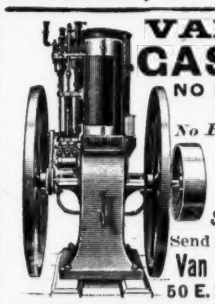

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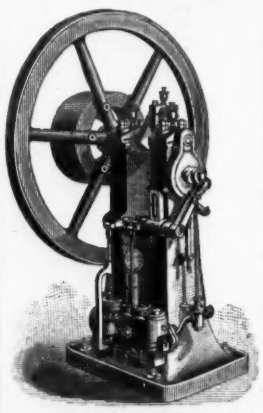

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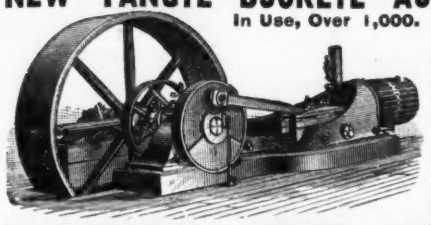

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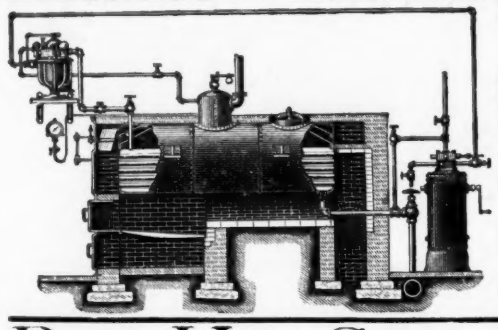

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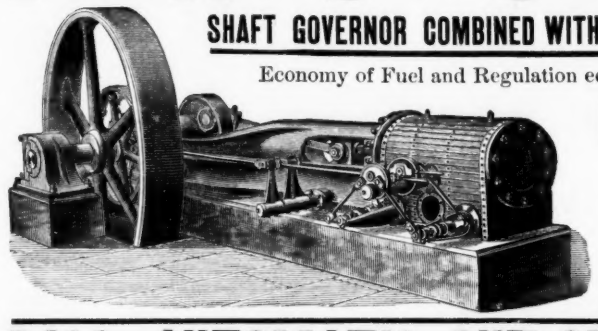

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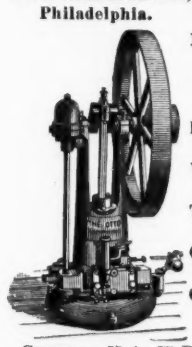

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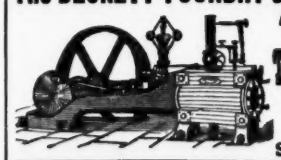

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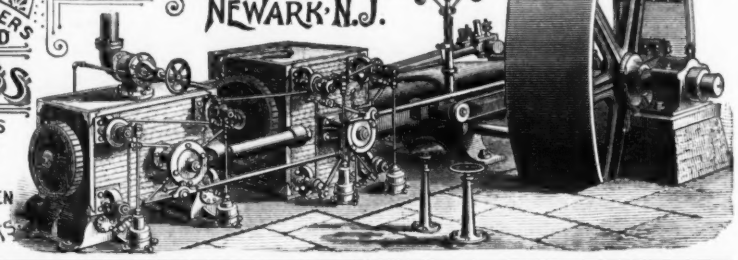

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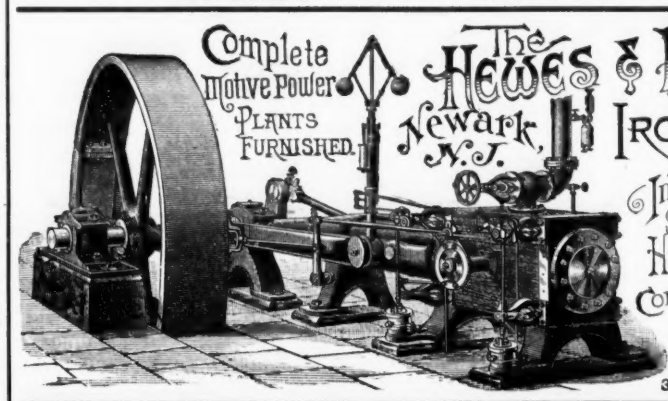

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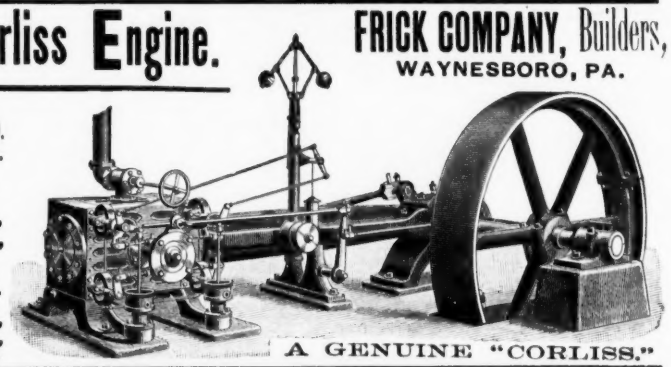

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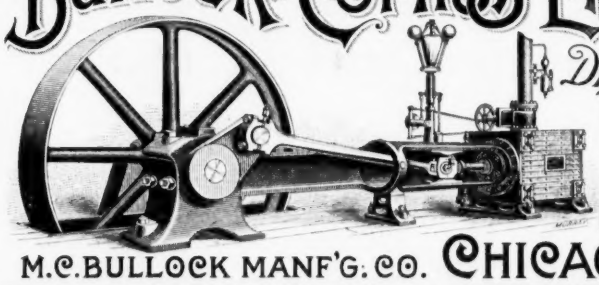

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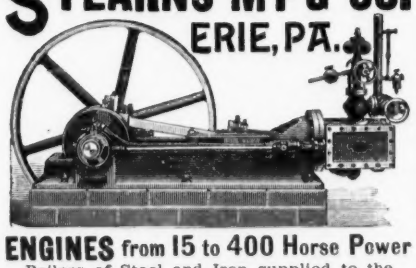

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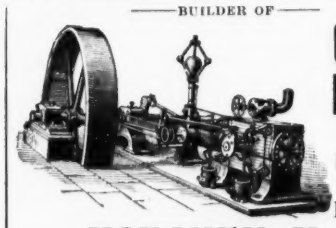

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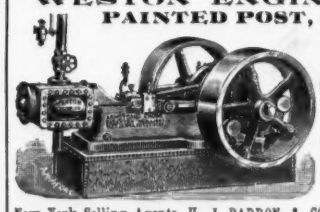

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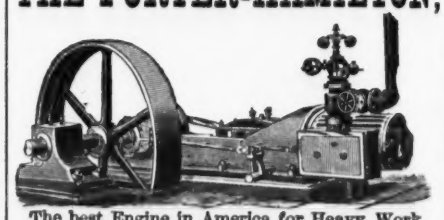

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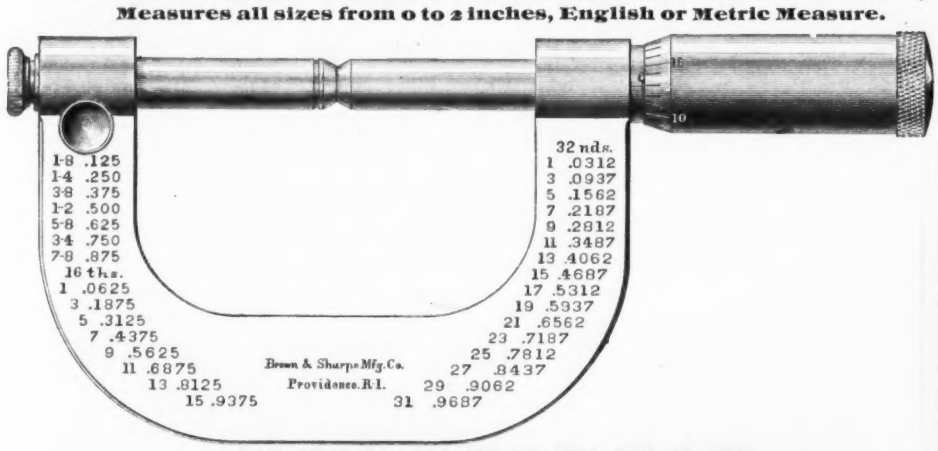

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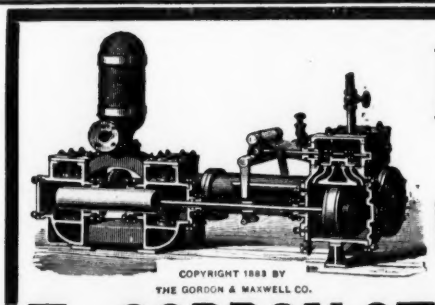

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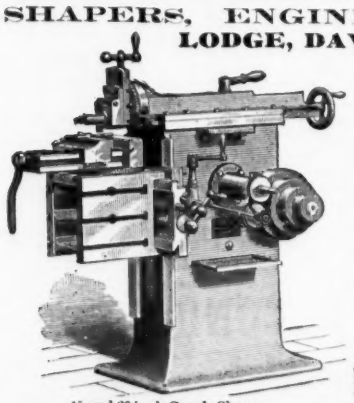

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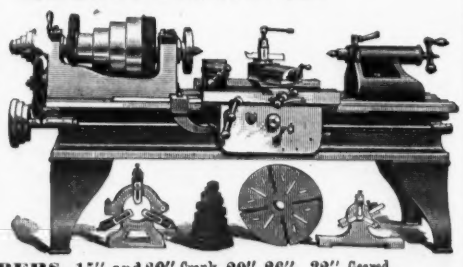

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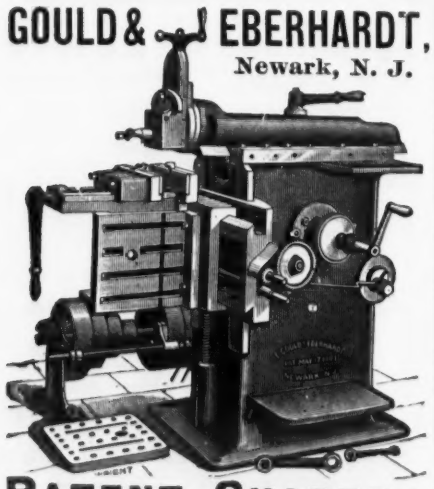

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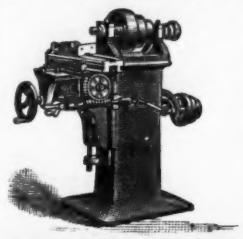

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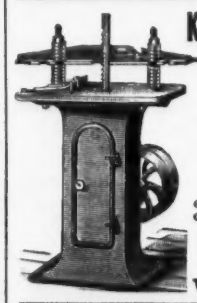

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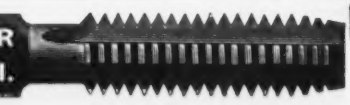

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